

SATURDAY, JULY 29, 1871.

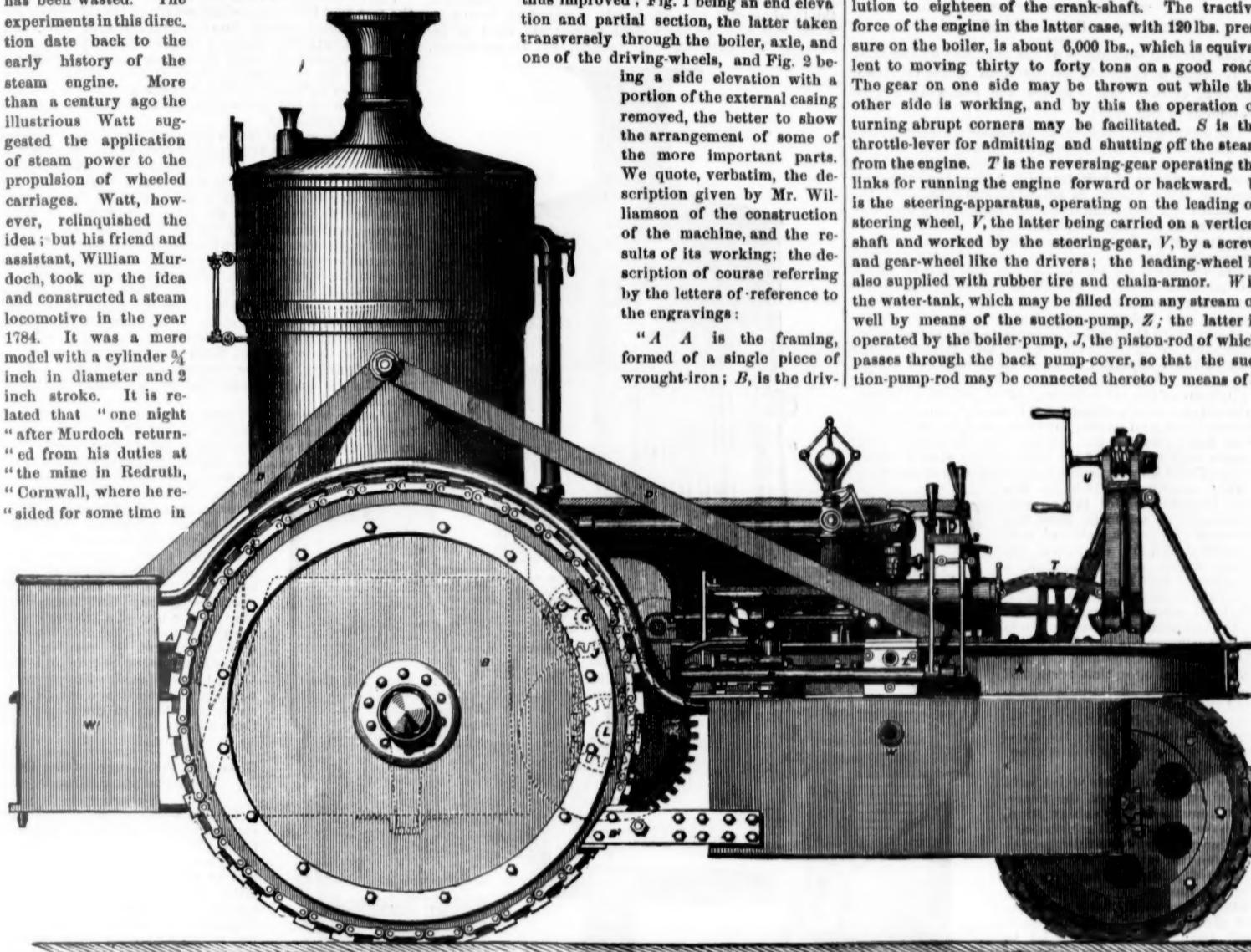
THOMSON'S ROAD STEAMER.

The construction of a locomotive steam carriage to run on common roads is a problem over which many sanguine inventors have dreamed, and much money has been wasted. The experiments in this direction date back to the early history of the steam engine. More than a century ago the illustrious Watt suggested the application of steam power to the propulsion of wheeled carriages. Watt, however, relinquished the idea; but his friend and assistant, William Murdoch, took up the idea and constructed a steam locomotive in the year 1784. It was a mere model with a cylinder $\frac{1}{2}$ inch in diameter and 2 inch stroke. It is related that "one night after Murdoch returned from his duties at the mine in Redruth, Cornwall, where he resided for some time in

"The Thomson steamer, as constructed and used in this country, differs materially from its English prototype, Mr. D. D. Williamson, of No. 32 Broadway, New York City, the owner of Thomson's American patent, having introduced several important modifications which add much to its general utility. These relate mainly to the steam-generator, a vertical steel tubular boiler, the tubes in the lower tube-sheet, three-quarters of an inch, and those in the upper, three-eighths of an inch apart, having been substituted in place of the comparatively clumsy pot-boiler employed by Mr. Thomson. Our engravings represent the steamer as thus improved; Fig. 1 being an end elevation and partial section, the latter taken transversely through the boiler, axle, and one of the driving-wheels, and Fig. 2 being a side elevation with a portion of the external casing removed, the better to show the arrangement of some of the more important parts. We quote, verbatim, the description given by Mr. Williamson of the construction of the machine, and the results of its working; the description of course referring by the letters of reference to the engravings:

"A A is the framing, formed of a single piece of wrought-iron; B, is the driv-

ing which is worked by another gear on the crank-shaft, G; this gear being the same size as H. On the end of the shaft, L, carrying the intermediate gear, J, are placed pinions, K. The pinions, H and K may be shifted out of gear with the main gear on the driver by means of the levers P and R. N and O are levers that take hold of the pinions, H and K, by means of projecting rims on one side, by which arrangement the pinions may be shifted sidewise on the feathers of the shaft. When H is in gear, the driver makes one revolution to six of the crank-shaft; when K is in gear, the driver makes, by means of the intermediate gear, J, one revolution to eighteen of the crank-shaft. The tractive force of the engine in the latter case, with 120 lbs. pressure on the boiler, is about 6,000 lbs., which is equivalent to moving thirty to forty tons on a good road. The gear on one side may be thrown out while the other side is working, and by this the operation of turning abrupt corners may be facilitated. S is the throttle-lever for admitting and shutting off the steam from the engine. T is the reversing-gear operating the links for running the engine forward or backward. U is the steering-apparatus, operating on the leading or steering wheel, V, the latter being carried on a vertical-shaft and worked by the steering-gear, W, by a screw and gear-wheel like the drivers; the leading-wheel is also supplied with rubber tire and chain-armor. W is the water-tank, which may be filled from any stream or well by means of the suction-pump, Z; the latter is operated by the boiler-pump, J, the piston-rod of which passes through the back pump-cover, so that the suction-pump-rod may be connected thereto by means of a



THOMSON'S ROAD STEAMER.—Fig. 2.

"charge of the mining engines, he wished to put to the test the power of his engine, and selected the gravelled walk leading up to the church. He lighted the fire, or lamp, under the boiler, and off started the locomotive, with the inventor in full chase after it. At the same time the worthy pastor of the church was coming from the opposite direction, and met this, the first steam carriage, and afterwards declared it to be the "Evil One in *propria persona*." Since that time numberless plans have been devised and experiments made with steam carriages. The difficulty has always been to adapt the engine to the inequalities of the road. Mr. Thomson's invention of the elastic tires has been the first entirely successful solution of this problem. It has made it possible to run his engines over any ground, however rough and strong or soft and yielding. It will go with equal facility over the roughest turnpike, or crosswise over a ploughed field. It can be turned and moved as quickly as a man on horseback, and could be run through the woods as fast as a horse and wagon could be driven without touching any of the trees. Hardly any grade which is practicable on a common road is too steep for it, and it will draw a train of wagons, a gang of plows, or a canal boat.

The success of these engines seems to indicate that they will come into very general use, and that they will be applied to a great variety of purposes. It is to be hoped that the experiment may soon be tried of applying them to some good macadamized road for the transportation of freight and passengers for some considerable distance. For the following description of these engines we are indebted to the *American Artisan*:

wheel, made entirely of wrought-iron; the peculiarities of its construction being plainly shown in the cross section. It is five feet in diameter, and is surrounded by the rubber-tire, B1, which is twelve inches wide and four and a half inches in thickness, and lies between projecting flanges."

The outer rim of the wrought-iron wheel is perforated (as shown in the cross section) by numerous holes about half an inch in diameter. These are put there to allow the air between the rubber and the rim to escape. A great deal of difficulty was at first encountered by the air which remained between the two, and which caused the rubber tire to slip. This evil, which was very annoying and troublesome, was entirely obviated by perforating the wheel as shown.

"Partly to produce a better hold on slimy ground, and partly to protect the rubber, the latter is covered by a shoe-chain or chain-armor, B2, which is held in position by means of side-guards, B, one on each side. C is the steam boiler, which is vertical and tubular, having 121 tubes, one and a half inches in diameter, giving a fire surface of 130 square feet in the tubes, and a heating surface of 24 square feet in the fire-box; total heating surface, 154 square feet, and seven square feet of grate surface. D D are wrought-iron trusses connecting the top of the boiler to the frame, A, and supporting the same in its vertical position. E is the steam-pipe leading to the cylinder, F, each of the two cylinders being six inches in diameter and having ten inches stroke. E is the exhaust-pipe; G is the crank-shaft; H a gear on each side of it gearing into I on the drivers; J is an intermediate gear inside the frame,

sleeve and key. W W are the coal-bunkers, one on each side of the platform on which the fireman stands. X is the drawbar and pin, to which the load to be hauled is attached. The total weight of this road steamer is six tons, and it is calculated at eight nominal horse-power. So far it has stood some severe tests in this country. Among others, at Paterson, N. J., it drew a gang-plow containing seven plows, each cutting a furrow fourteen inches wide by eight inches deep, at a speed of two and one-half miles per hour. This road steamer may also be changed to a portable engine for agricultural or any other purpose, such as threshing grain, cutting wood, pumping water, etc. This is done by placing in the bearing, M, an extra gear-shaft with fly-wheel and pulley for this purpose. The engines are supplied as shown with a Porter governor and throttle-valve to regulate the speed.

"The exhaust-nozzle is of annular form and about six inches diameter, its peculiarities of structure causing the draught to be better distributed throughout the entire cross section of the boiler than those more commonly in use; it also secures less noise, a matter in itself of no little consequence. The steam-pipe is placed underneath the engines in the English; in this, it is placed above, by which easy access to the throttle-valve may be had in case the same should leak or be otherwise disabled. The pump is also placed in a more convenient position, and is operated by an eccentric on the shaft, L, by means of a rocker. There is provided an additional suction-pump, Z, by which the tank may be filled from a stream or well by means of a temporary, flexible suction-hose, thus obviating the necessity for

carrying the water by buckets, in circumstances where a stream cannot be poured directly into the tank.

The utility of this engine for tractive uses was highly commended by a committee specially appointed by the Farmer's Club of the American Institute to examine its practical operation in the drawing of heavy loads, in quick turning within narrow compass, and in ease of management when in use."

Mr. D. D. Williamson, the owner of the American patent for this engine, has his office at No. 32 Broadway, New York, and will be glad to give any further information concerning it.

State Aid to Railroads in Georgia.

Exaggerated statements of the aid given by the State of Georgia to railroads having been made, Governor Bullock, of that State, makes the following official statement of the case:

The contingent liability of the State is represented by what is commonly known as "State aid" to railroads, although, under the present Constitution of this State, the policy of "State aid," which has been pursued in other States, is entirely prohibited, and the Legislature is restricted to simply authorizing the State indorsement for the prompt payment of the interest and principal on the first mortgage bonds of certain railroad companies, after the roads have been constructed and are in operation for sections of ten and twenty miles, the indorsement not to exceed, in any case, one-half of the cost of such road. The State has, as a protection against such indorsement, a first lien upon the whole property, with the right of immediate and unobstructed possession of the property, upon any failure on the part of the companies to meet their indorsed obligations.

(In some of the other States, before and since the war, railroads have been aided by the States becoming large shareholders, and paying for their stock by the issue of State bonds, and in this manner have burdened their people with a debt. As I have before stated, every thing of this kind is prohibited by our Constitution.)

This contingent liability has been incurred, under the circumstances above set forth, upon the Macon & Brunswick Railroad, now completed and in operation between Macon and Brunswick, a distance of two hundred miles, to the extent of \$18,000 per mile. The total amount, however, of the State's indorsement upon the bonds of this company is but \$2,550,000. This contingent liability has also been incurred upon that portion of the Alabama & Chattanooga Railroad running through this State, a distance of 243-10 miles, to the extent of \$8,000 per mile, the total amount of the State's indorsement being \$194,400.

The only other roads which have organized and secured the necessary amounts of cash subscription, and have constructed the necessary number of miles to entitle them to indorsement, are the South Georgia & Florida, from Albany to the Florida line, which is entitled to an indorsement of \$8,000 per mile; the Brunswick & Albany Railroad, running from Brunswick to the Alabama line, which is entitled to \$15,000 per mile indorsement upon gold bonds; the Cherokee Railroad, running from Cartersville to the Alabama line, which is entitled to an indorsement of \$12,500 per mile, and the Atlanta & Richmond Air-Line Railroad, from Atlanta to the South Carolina line, which is entitled to an indorsement of \$12,000 per mile.

The South Georgia & Florida Railroad, when completed to the Florida line, will be 73 miles in length, with a total indorsement of \$554,000. The Brunswick & Albany Railroad, when completed to Eufaula, will be 243 miles in length, with a total indorsement of \$3,630,000. The Cherokee Railroad, when completed to the Alabama line, will be 47 miles in length, with a total indorsement of \$12,500.

When all the railroads, which have up to this time placed themselves in a condition to be entitled to the indorsement of the State, shall have been completed, the total contingent liability of the State will be \$7,545,900.

The statutes authorizing these and other railroads to receive the State's indorsement, under the restrictions that I have explained, were passed by a large majority of the General Assembly. This question has never been a political one here; the bills were voted for by Democrats and Republicans, and are almost unanimously approved by the people of the State. The small minority in the Legislature opposed to the policy were about equally divided between the two political parties.

The only exceptions to the general rule are in the case of the Brunswick & Albany, Macon & Augusta, and Atlanta & Richmond Air-Line railroads. The Brunswick & Albany Railroad Company was organized by northern capital before the war, and had constructed some sixty miles of railway from Brunswick west. During the war, as is alleged, the iron from this road was taken up by the then State authorities and placed upon the Atlantic & Gulf Railroad, in which the State was and is a large stockholder, and upon the Western & Atlantic Railroad, belonging exclusively to the State.

This company, reorganized since the war, having rebuilt over one hundred miles of their road, proposed, as a settlement of their claims against the State, a plan which was accepted by the Legislature, whereby the company deposits with the State \$10,000 per mile of seven per cent. second mortgage gold bonds having twenty-five years to run, and receives from the State \$8,000 per mile of seven per cent. gold bonds of the State from time to time as the road is constructed. As the Brunswick & Albany Railroad Company pay 7 per cent. to the State Treasury upon \$10,000 per mile, the interest paid by the State on her bonds, to the amount of \$8,000 per mile, is provided for, and the surplus forms a sinking fund which provides for the redemption of the bonds at maturity. When the Brunswick & Albany Railroad shall have been completed to Eufaula, the total amount of State bonds received by it will be \$1,880,000, and the State debt proper will then be increased by that amount secured as above stated.

on its bonds, together with a fair rate of per cent. to its stockholders, is secured. The Alabama & Chattanooga road, owing to its complications in connection with its larger debts in Alabama, has failed to meet its interest in January and July. The State, however, has promptly met its liability by paying the interest on the bonds indorsed by her, and is amply secured by the value of that portion of the road lying within the State upon which her indorsement rests. Large gangs of hands are working upon the roads not yet completed, and it is believed that they will be completed before the first day of October next. That portion of these roads already constructed and in operation is reported as doing a fair business, and each company has promptly paid its interest on bonds indorsed.

I have heretofore referred, in this communication, to the fact that the value of the return of taxable property has increased nearly fourteen millions in 1869, and nearly twenty-two millions in 1870, as compared with the years previous; and, upon analyzing this fact, we find that the increase has been directly stimulated by the lines of railroad which have been put into operation by reason of the assistance given them through the State's indorsement.

It is quite natural that a practical man should inquire what benefit railroad companies derive from this limited indorsement by the State. But that inquiry is answered when we reflect upon the fact that a portion of the money necessary for the construction of these roads must be obtained from the Northern States or from Europe, and that neither in the North nor in Europe would capitalists take the time or the trouble to inquire as to the solvency of comparatively unknown corporations in the South, which might present themselves offering to sell their securities; but when these securities carry with them the guarantee of the State of Georgia for the prompt payment of the interest and the principal of the securities that are offered, the capitalist, relying upon that indorsement, finds it unnecessary to make further inquiry, and the corporations are thus enabled to make the negotiations that are necessary for their success.

In other words, the people, having capital sufficient to subscribe and pay for an amount of stock necessary to pay the cost of construction of the first section of their proposed road, are enabled to borrow, upon their bonds thus indorsed, the money necessary to pay for half of the cost of the continuation of construction. And when, as in the case of the Atlanta & Richmond Air-Line, or the Macon & Augusta Railroad, their work has progressed to such an extent as to attract to it public attention and confidence, they find themselves able to obtain even a greater credit than the State is permitted to indorse for, and by retiring the bonds bearing the State's indorsement, they are enabled to progress without the assistance which was really necessary in the infancy of their enterprise.

Changing the Gauge of the Ohio & Mississippi Railroad.

This is a day of great railroad enterprises, and of mighty railroad feats. When the Union Pacific road was constructed and track laid at the rate of three and four miles per day, we thought there was nothing left to be done in this connection to astonish the people. But in this we were quite mistaken, for yesterday the Ohio & Mississippi Railroad authorities and those in their employ accomplished a work which, for completeness of preparation, extent of the work and the dispatch with which it

was accomplished, quite eclipsed all previous railroad feats.

In 1857 the entire line of the Ohio & Mississippi road was opened, creating somewhat of a sensation, inasmuch as it was a broad-gauge, being about 15 inches wider than the usual roads of the country. The capacity of its coaches, with increased comfort, attracted the attention of travelers, who were not slow to see the benefits which the spacious cars furnished them in their passage through the country.

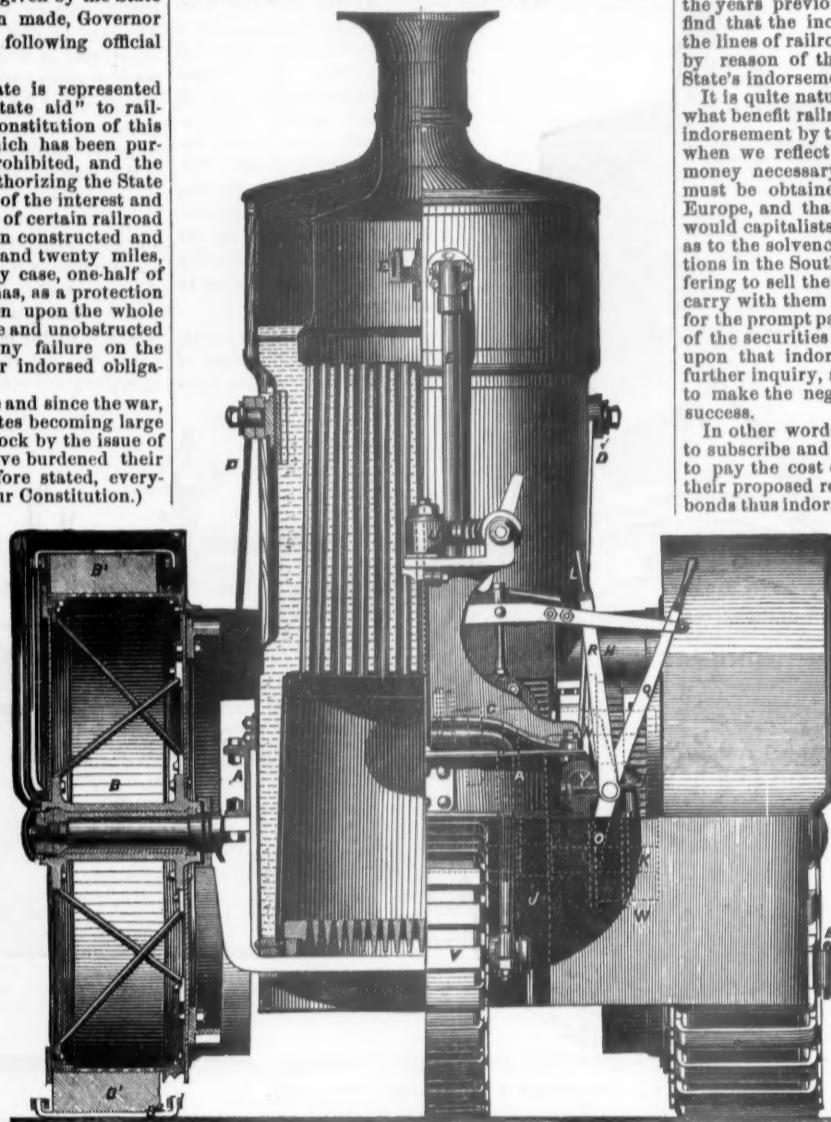
There were those in that day that foresaw what has since become plain to many others, namely, that this increased capacity was at the expense of rolling stock and track, and that the broad-gauge would hardly be able to compete finally with the narrow-gauge roads, to which the railroad mind was more and more turning each year.

The officers of the Ohio & Mississippi road were impressed for years with the disadvantages entailed upon them by the six-foot gauge, disadvantages in connections, in the through car traffic, and in the increased amount of dead weight necessarily attached to the broad-gauge engines and cars, and a change was meditated as soon as it could be accomplished.

But it was not a child's work to make the change. A large outlay of money was necessary, and the preparations made were of no ordinary magnitude.

On the 28th of January last the change to four feet nine inches was determined on, and the officers at once set themselves at work to prepare for the work. It was, however, not until April that active preparations began.

When it is remembered that the company had 340 miles of road, besides the Louisville Division, 87 locomotives, 1,500 cars, hand cars and other machinery, besides side-tracks, all of which sooner or later had to be changed, a part of it before the change in the track,



THOMSON'S ROAD STEAMER.—Fig. 1.

some idea of the activity of the measures to be adopted may be formed.

Anticipating the new order of things, 40 new locomotives were purchased, all of which have been delivered, and are now ready. Five new passenger coaches were provided. Twenty-eight engines and 700 cars, of various kinds, were changed from the broad to the narrow-gauge, the engines at a cost each of \$3,500.

Beside this, the broad-gauge rolling stock had to be so disposed as to have it all at last where the changes could be made, which was at Cincinnati, St. Louis, Vincennes, and Cochrane. Seven hundred and fifty new freight cars and three hundred new box cars were contracted for.

While this was going on men were busily employed preparing to change the track. All the curves were surveyed, and on nearly all of them the track was laid, inasmuch as here the change could not so readily be made by moving in the old rails. The ties were channeled, that is, hewn off with the adze on the upper surface at the point where the old rail was to rest, which was seven and a half inches inwardly from the old position. To facilitate the business, in the alternate cross-ties, at the point where the inner side of the rail was to rest, spikes were driven so that the rail when released from its old fastenings could be moved immediately against them, and at once occupy the new position. This work was proceeding for weeks. At the same time preparations were made to change side tracks. The switches, small as they are, were troublesome, but this was finally solved by cutting all the rods that would be needed, and then splicing them, so that when the splice should be removed the connection between the rod and the outer rail could be made at once. To still further expedite the business the old spikes in the alternate ties were removed, in order to reduce the labor on the day of change to the minimum.

The day for the culmination of the plans drew near, and there was nothing incomplete. The last passenger trains on the broad gauge left Cincinnati and St. Louis on Saturday morning. At daylight the hands were sent over the road. The employees of other roads had been drawn upon to the number of one thousand, swelling the whole number for the last day to about twenty-five hundred. The force was divided into squads of seven men, each squad taking one mile, and the squads of each five miles assigned to a section boss.

At midnight, on Saturday, the rolling stock of the road was all disposed according to pre-arrangement, and the road bed was ready for the contemplated change. At the first blush of dawn Sunday morning the work commenced along the entire line. The squads in each section, divided in two parts, commenced at the outside of the section and worked inwardly, the two parties approaching each other. A part of the force drew the spikes that held the old rails, and when they were sufficiently advanced, others were ready to apply their tools and shove the rail inwardly to the place designated by the spikes already driven—several rails might be moved at once, for it must be remembered that on nearly the whole of the road is the fish-joint rail, the several rails being bound together as one, so that it was like moving the whole track. The rail once moved to its place, the remainder of the party came, and in the alternate ties drove the outside spikes, which finished the work.

The first section finished was at Adamson, at 4:25 in the morning. This was followed by others that came in quick succession, so that by 11 o'clock in the morning, T. Gazlay, Esq., the attorney of the road, received dispatch from Engineer Lovett, saying the work was done, having been accomplished in an average time to each section of about seven hours.

It was a great work grandly prepared for and triumphantly achieved. Without disparagement to any, we may say that all the work pertaining to the superstructure and track was prepared for by Thomas D. Lovett, Esq., Chief Engineer of the road, and executed under his direction and that of his faithful subordinates, while the disposition of the rolling stock and clearing the road for the change was under the control and management of J. L. Griswold, Esq., General Superintendent. That they both did their duty faithfully and ably our readers need not be informed. The road, with its strong, broad bed, hardly equaled now for the capacity of its foundations, will this morning bear the first passenger train of the new gauge, leaving the city at the usual hour—a splendid triumph for all concerned.

It seems but proper that the names of the officers of the road and the heads of the departments should be named in this connection. It must be remembered, however, that the determination to make a change, and the first preparations for it, were before the resignation of the late President, who resigned, to take effect in April:

D. Torrance, President; A. N. Chrystie, Vice-President; T. D. Lovett, Chief Engineer; J. A. Smith and R. L. Engle, Assistant Engineers; J. L. Griswold, General Superintendent; M. M. Martin, Assistant General Superintendent; W. W. Jones, Superintendent of Construction of Western Division; Thos. Adamson, do. of Eastern Division; H. Elliott, Master Mechanic of the Western Division; A. Thompson, do. of the Middle Division; J. D. Potts, do. of the Eastern Division; Wm. Brownlee, Superintendent of Western Division; T. Van Name, do. of Eastern Division; E. C. Ryder, Master of Trains; E. S. Duval, Superintendent of Bridges, and the following roadmasters: H. D. Hanover, Ass. Soule and Wright Kenner, of the Western Division; Wm. Beman, James Reynold, James Calhoun and Robert Burke, of the Eastern Division, and P. Wiggins, of the Louisville Division.—*St. Louis Republican*, July 24.

Offset, or Dropped, Grate-Bar.

Mr. H. K. Bates, a locomotive engineer at Fort Scott, Kansas, has introduced a grate-bar which he has himself applied and used in fire-boxes from most of the locomotive works in the country. The accompanying engravings show these grate-bars in position, one side of the fire-box being removed. Fig. 2 shows the form of a single bar, and Fig. 3 is one of the side blanks, which form a portion of the side of the fire-box, since the bars hang below the fire-box ring. The object of these blanks is to prevent the fire from coming in contact with the lower row of rivets, or from falling into the ash-pan.

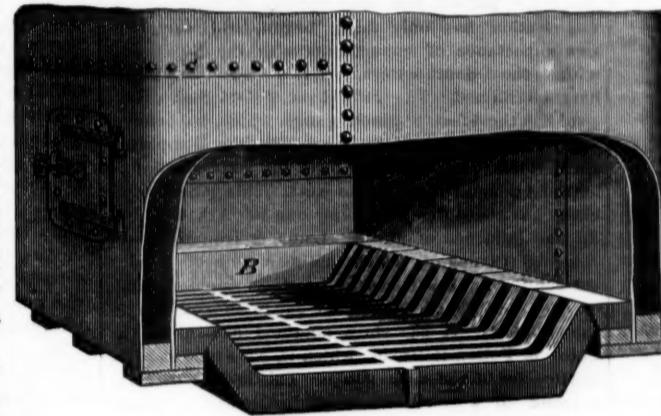
By this means an increased depth of fire-box is obtained. The inventor claims that, since a direct draught across the surface of the grate-bars is allowed, the locomotive will steam more steadily and surely with the same quality, and a much less quantity, of fuel.

Mr. Bates will furnish further information if addressed at Lock Box 1330, Fort Scott, Kansas.

MECHANICS AND ENGINEERING.

Rock Island Bridge.

The Rock Island *Union* gives information of the progress of this work: "The coffer which is being constructed in the Mississippi, under the direction of Ma-



OFFSET, OR DROPPED, GRATE-BAR.

Fig. 2

Fig. 3

and Sedalia, Mo.—and are also renewing about twenty bridges for the Missouri Pacific Company.

Model of Locomotive and Car for Japan.

The Baldwin Locomotive Works have just completed a model of a locomotive, and the Jackson & Sharp Company a model of a car, for the Commission which is about to visit Japan in the interest of its government. They are both made to a scale of 1 inch=1 foot, and are complete in all their parts. The locomotive, especially, shows every detail. It is not a working model, but will illustrate every part and serve to give a clear idea of the construction and equipment of an American railroad. The model was built by John Divine, a graduated apprentice from this establishment.

Narrow-Gauge Cars.

The Jackson & Sharp Car Company, of Wilmington, Del., have just completed six narrow-gauge cars for the Denver & Rio Grande Railroad. The following description is from the Philadelphia *Bulletin*. We will soon give our readers engravings and full descriptions of these cars:

"These are the first 'narrow-gauge' passenger cars ever built in the United States, and are splendid specimens of American workmanship. They are three feet gauge, 35 feet in length, 7 feet in width, and 10 feet 6 inches in height, weight 15,000 lbs., and will comfortably seat 34 passengers. Every effort has been made to keep the center of gravity as low as practicable. The main sills are distant 27 inches from the rails, which is 18 inches less than customary on the broad-gauge roads. The cars are supplied with every convenience, and, by the peculiar conformation of their trucks, are made to run with the greatest ease.

"The outside coloring is a chocolate brown picked with gold and yellow, and a center medallion contains the name assigned to each in gilt lettering.

"The interior is of black walnut, beautifully finished, with silver-plated hat and coat hooks, silver-mounted lamps, comfortable closets, neat and serviceable water coolers, and heated by patent wood stoves. Along one side extend a row of double seats, and on the other side are found single ones. These are of scarlet plush, spring bottom, with 'figured green' plush backs, the frame work being iron and ash. The cars are well ventilated, built in saloon style, and have an inside height of seven feet six inches.

"The 'smoking-car' is somewhat different, the seats being placed in the center, and the entrances being from both ends and sides. The wood work is polished ash, finished with black walnut. Closets, lamps, stoves and hooks are provided as in the car above described.

"The passenger carriage is run on four-wheel trucks, whilst the smoking and baggage-cars are run on two axles each. These latter are somewhat smaller than the passenger, and weigh only 6,750 pounds.

"They reflect much credit on the Jackson & Sharp Company, and will, no doubt, prove very acceptable to the patrons of the Denver & Rio Grande Railroad."

The St. Joseph Bridge.

At a recent meeting of the directors of the St. Joseph Bridge Company, Colonel E. D. Mason, Chief Engineer, submitted the following report in regard to the location of the bridge:

"In obedience to your instructions, I submit an estimate of the cost of a bridge located at a point between Charles and Jule streets, in the city of St. Joseph.

"In order to build a bridge within these limits, it would be necessary to force the current of the Mississippi River against the easterly bank and maintain it there. This would require an expenditure of \$200,000.

The narrowest point in the bed of the river between Charles and Jule streets, perpendicular to the current, is 3,000 feet. As your bridge is to be 1,300 feet long, this will leave 1,700 feet of your western approach to be built in the bed of the river.

"It would not be prudent to make the whole of this approach embankment. At least 600 feet of it should, for some time to come, be left for water-way. This water-way would require three piers and 600 feet of superstructure. Should the piers be founded on piles, they would cost, say, \$30,000 each. The substructure would cost, say, \$100,000. The balance of the western approach might be embankment, which would have to be riprapped, and would cost, say, \$60,000.

"The right of way for the eastern approach could not be otherwise than very expensive. A curve of less than 600 feet radius should be used. If you locate your bridge at Jule street, your approach would extend as far east as Second street. If you locate at Charles street, then the approach will reach as far as Fourth street. At any intermediate point the approach would extend, say, as far as Third street. I would not, therefore, estimate the eastern approach, including right of way, at less than \$150,000. The cost of a bridge located between Jule and Charles streets should be estimated as follows:

Bridge	\$710,000
hanging and maintaining channel	20,000
Western approach	250,000
Eastern approach, including right of way	250,000
Total	\$1,210,000

Over one hundred car loads of stone for the piers of this bridge have already been quarried, and their shipment commenced this week. The boats and contractors' material used on the Hannibal bridge are expected to arrive at St. Joseph next week, and work on the first pier, on the west side of the river, will begin about the 1st of August.

The Hannibal Bridge.

The draw of this bridge was swung for the first time on the 23d inst.

Camp's Dumping Car.

Experiments have been made lately with this car at an excavation for the car shops of the Lehigh Valley Railroad, in Wilkesbarre, Pa. It gave entire satisfaction, and the officers of the road who observed its working express themselves satisfied that it causes a great saving of labor.

American Bridge Company.

This company has the contract for all the bridging on all divisions of the Missouri, Kansas & Texas road. At the Arkansas River they are building both the masonry and the superstructure—a Post combination truss to consist of four 200-foot spans. Over the Verdigris River they have a similar contract for a bridge of three spans, one 200 feet, and two 25 feet.

Two draw-bridges are in course of construction over the Minnesota River, one for the Minneapolis & St. Louis Railroad, and one for the Hastings and Dakota Company, both at Carver, Minn.

This company is also building all the bridges of the Wisconsin Central Railroad. These works will all be of wood, except the bridge over Wolf River, which is to be a combination draw of wood and iron.

The \$100,000 bridge over the Illinois River, for the Chicago & Alton Company, between Roodhouse and Louisiana, will be completed in about three weeks. This will be one of the most substantial structures in the State.

The company has the contract for all the bridges of the Lexington & St. Louis road—between Lexington



PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, if not previously published, FREE OF CHARGE. They are invited to send us drawings or models and specifications. When engravings are necessary, the inventor is expected to furnish his own engravings, or to pay for them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Our Prospectus and Business Notices will be found on the last page.

THE STANDARD GAUGE OF AMERICA.

The recent change of gauge of the Ohio & Mississippi Railroad from 6 feet to 4 feet 9 inches is another and a most marked indication of the irresistible movement toward uniformity of gauge. Within three years we have chronicled similar movements on three long and important lines. Not quite three years ago the gauge of the Pacific Railroad of Missouri was changed from 5 feet 6 inches to the standard 4 feet 8½ inches, on a line 283 miles long.

Before that time the Great Western of Canada, whose original gauge was also 5 feet 6 inches, had laid a third rail to accommodate its connections east and west, which are of the standard gauge. Within a year past it has changed the gauge of its branches (of considerable length) and taken up the outside rail which made the 5-feet 6-inch gauge, and it now has only the standard gauge and standard-gauge rolling stock. Now, lastly, we have this change of the Ohio & Mississippi. These three roads, with the branches and connections which they control, have an aggregate mileage of 1,154 miles of road. In the United States, west of Buffalo and north of the Ohio, the only exception to the standard gauge, we believe, is the Atlantic & Great Western—that is, out of more than 25,000 miles of railroad in the section named, only about 500 vary from the standard gauge of 4 feet 8½ inches.

The only important lines in the North which vary from the standard gauge are, at present, the Erie Railroad, operating 940 miles; the Atlantic & Great Western, 425 miles; the Delaware, Lackawanna & Western, 530 miles, and the Albany & Susquehanna, 164 miles. This gives a total of 2,059 miles of broad-gauge (6 feet) railroad and about 41,000 miles of standard gauge in the Northern United States.

But even with this showing we cannot claim that the gauge of 4 feet 8½ inches is a *national* gauge. While it has become almost universal in the North, and while the mileage of broad-gauge roads is decreasing in the face of an enormous increase of standard-gauge, it remains true that the South, with nearly one-quarter of the mileage of the country, has a standard of its own, the 5-feet gauge. But although this gauge is so prevalent as to entitle it to be called the Southern standard, yet the standard of the North has made considerable innovations southward. For instance, all the railroad, in Virginia north of the James, with

the exception of the Richmond & York River, 43 miles long, have the Northern standard gauge, and these include all the important lines in the State, except the Atlantic, Mississippi & Ohio, extending from Norfolk entirely across the southern part of the State to Bristol. Indeed, the narrower gauge has made invasions further south, and the Richmond & Petersburg, 46 miles; the Petersburg Railroad (Petersburg to Weldon), 82 miles; the Seaboard & Roanoke (Norfolk to Weldon), 80 miles; the Wilmington & Weldon, 181 miles; the Raleigh & Gaston, 97 miles; the Atlantic & North Carolina (Morehead City west by north to Goldsboro), 95 miles, and the North Carolina Railroad (Goldsboro to Charlotte), 223 miles, all conform to the Northern standard. Nearly or quite two-thirds of the mileage of Virginia and one-half of that of North Carolina is of 4-feet 8½ inches gauge, and the cars which run into Boston, New York, Chicago and San Francisco can run as far south as Wilmington, near the southeast corner of North Carolina, and (by a circuitous route) to Charlotte, near the southern border of the same State 200 miles from the coast.

West of the Mississippi, in the South, we find a mixed gauge again, and more so than elsewhere in the country. Indeed, the construction of railroads in this section has only fairly begun, and the relative importance of connections with the North and with the Southeastern States has not yet been determined. The Little Rock & Fort Smith Railroad has the 4-feet 8½-inch gauge, which, we believe, is the gauge of its eastern connection, the Memphis & Little Rock. Together they form the only trunk line across Arkansas from east to west. This gauge might easily have been the prevailing one of Arkansas but for the influence of the St. Louis & Iron Mountain Railroad Company, which, finding a connection with the Southern railroads east of the Mississippi essential, or very desirable, changed its gauge to conform to theirs (5 feet). It has since obtained control of the Cairo & Fulton Railroad, which is, we suppose, to be constructed of the same gauge. This is likely to form a trunk for a system of railroads through Arkansas, and the desire to connect with it may determine the gauge of many new lines in that State. The Atlantic & Pacific, of Missouri, however, is likely to have feeders from this State, which will have its gauge. There will soon be a railroad of considerable length of 3-feet gauge in this State.

Further south, the North Louisiana & Texas Railroad, completed from Vicksburg to Monroe, 72 miles, has a gauge of 5 feet 6 inches, which is also the gauge of the Houston & Texas Central (220 miles), and, we believe, the Galveston, Houston & Henderson. The Galveston, Harrisburg & San Antonio road (84 miles), and the Houston Tap & Brazoria (50 miles) have the 4-feet 8½-inch gauge. The road from New Orleans to Opelousas (85 miles) has the 5-feet 6-inch gauge. The Southern Pacific (now owned by the Texas Pacific Company) has 66 miles of road of the gauge of 5 feet.

As the intercourse between the North and the South increases, and it does continually and rapidly, the desirability of uniformity of gauge will become more and more evident, and as the mileage of the Northern standard is probably four times as great as that of the Southern, it is evident that when a change is made, the former will prevail.

The roads of 6-feet gauge in the North feel more and more their isolation from the railroad system of the country. The Atlantic & Great Western is likely soon to have a new management which will much desire to become independent of the Erie road. It can become so only by a change of gauge. With the standard gauge it could have two competitors for its traffic eastward: at present the Erie alone can take its cars to the East. With the narrow gauge, moreover, it would be well situated to do a New England business, for which its location fits it much more than for New York traffic. The Erie itself would be able to compete for a traffic worth millions yearly, which now it cannot touch, if it but had the standard gauge. The Delaware, Lackawanna & Western suffers less from its isolation, as it is chiefly a coal carrier, and depends little on the traffic received from its connections. It is not impossible, however, that it may become the eastern outlet to a system of Western railroads in which case the standard gauge will be indispensable.

In this we have said nothing of the new narrow-gauge railroads. A considerable number of these are sure to be constructed, though there are none of considerable length in operation. All or nearly all of these in the United States are of 3-feet gauge; those in Canada have a gauge of 3 feet 6 inches. These will again break the uniformity which has become almost universal in the North by the reduction of the wide gauges. But so far we believe that no extended lines or systems

on this plan have been begun east of the Mississippi, and there is scarcely room to doubt that the gauge of 4 feet 8½ inches will remain the standard gauge of America.

The Atlantic & Great Western Railway.

This unfortunate railroad, which since 1867 has been operated by the Erie Railway Company, is likely soon to be in the hands of its stock and bondholders again. A little more than a year ago a scheme was perfected in England for a reorganization of the company, nearly all of the stock and bonds being held in that country. Some opposition to the scheme was manifested by a small section of the bondholders in Holland, and by the Erie Company, but the majority in favor of the scheme was overwhelming. The road was constructed by three distinct companies—one in New York, one in Pennsylvania, and one in Ohio—and each of these companies has first and second-mortgage bonds outstanding, and there is also an issue of bonds by the consolidated company. The total bonded debt is \$24,763,400, on which unpaid interest had accrued one year ago to the amount of \$6,609,500. There was then also a floating debt of about \$27,000,000; so that the total indebtedness of the company amounted to \$58,372,900. The capital stock of the company is \$30,000,000, so we have this line of 425½ miles of railroad representing a capital of nearly \$90,000,000, or more than \$200,000 a mile. The total debt is at the rate of nearly \$140,000 per mile, and the funded debt (not counting over-due coupons) at the rate of \$58,000 per mile, which is more than the total capital account of such a road should be. Of course the failure to pay the interest on the bonds is easily understood, especially when we consider that the direction of the road is not in the ordinary channel of traffic, which, in the country through which this road runs, is east and west, and not northeast and southwest.

The scheme for reorganization contemplated the sale of the road under the mortgages to the trustees of the bondholders. This part of the programme has been carried out. The New York section was sold a week ago, at Jamestown, on the 22d inst., to Hon. A. G. Thurman, one of the trustees; the Pennsylvania section, on the same day, at Philadelphia, to the same; and the Ohio section, on the 26th inst., at Akron. A new company is to be organized under the name "Atlantic & Great Western Railroad Company," the peculiarly American word "railroad" being substituted for the English "railway" in the old title.

The proposed capital is \$10,500,000 of first-mortgage, \$7,000,000 of second-mortgage, and \$24,343,600 of third-mortgage bonds, all with 7 per cent. interest in gold. The interest on the third-mortgage bonds is to be paid, if earned, within the year, or as much as may be earned within the year.

There is to be also \$6,944,656 of 5 per cent. preference shares, and \$1,621,744 of ordinary shares. Thus the total funded debt of the new organization will be \$41,843,600, the capital stock \$23,156,400, and the total capital \$65,000,000.

The holders of the various first-mortgage bonds of the old companies will receive first-mortgage bonds of the new company for the amount of principal and interest. The holders of the various second-mortgage bonds will receive the new second-mortgage bonds for their principal and interest; the holders of certificates of debenture of 1864 (of which the amount is \$14,000,000) will receive one-fourth of their face in first-mortgage, one-fourth in second-mortgage, one-fourth in third-mortgage bonds, and the remaining fourth in ordinary shares. The holders of the old consolidated bonds are to receive new third-mortgage bonds for the amount of their principal and preference shares for their interest. The holders of certificates of debenture of 1868 (about \$13,000,000) will receive one-fourth in third-mortgage bonds, one-fourth in preference shares, and one-half in ordinary shares.

The management is to be vested in a board of nine directors, one-third to be chosen annually. It is agreed that Maj. Gen. George B. McClellan shall be chosen President for a term of not less than three years.

Cincinnati to New York.

The Cincinnati papers have given some prominence to a scheme for a new railroad route between that city and New York, of which the proposed Kentucky & Great Eastern Railroad will form a part. This company's line is to be from Cincinnati east by south up the Ohio River to Catlettsburg, near the terminus of the Chesapeake & Ohio. Then, it is reported, a line is to be constructed northeastward across West Virginia to the Potomac at Point of Rocks, about ten miles below Harper's Ferry. At Point of Rocks con-

nection is to be made northward, chiefly by railroads already constructed, through York and Reading, Pa., to New York. It was claimed that this line would be but 626 miles long, or 120 miles shorter than the shortest existing route—that by the Pennsylvania Railroad. The distance from Cincinnati to Catlettsburg is given as 120 miles, and from Catlettsburg to Point of Rocks as 230 miles. From Catlettsburg to Point of Rocks the distance by an air line is 270 miles, and as that part of the line crosses the Alleghenies, it is not probable that a railroad between the two places could be made less than 300 miles long—certainly not 230 miles, and very probably 330. Indeed, the distance from Cincinnati to Point of Rocks is 370 miles in an air line, while this reckoning makes it but 360 by a railroad *via* Catlettsburg. The distance from Point of Rocks to New York can be made in about 266 miles, which is the distance given above, but unless branches of the Pennsylvania Railroad are used nearly 100 miles of this must be built close along existing roads.

But although there be so great a difference between the real and the asserted distance by this route, it remains short enough to be valuable as a through line, while the portion to be constructed ought to be valuable enough to justify its construction even if it should form no through connections. From Cincinnati to Catlettsburg a line is needed to connect Cincinnati and the country west and northwest of it with the Chesapeake & Ohio Railroad. The line through West Virginia would find scarcely any competition and a country of great mineral and agricultural resources. Moreover, it could carry traffic to Washington, Baltimore and Philadelphia quite as well as to New York.

The Rockford Central Railroad.

Arrangements have been made for the consolidation of this company with the Madison & Portage Company, whose line is already in operation from Madison to Portage and which proposes to extend its line from Madison southward by what is known as the "Sugar Valley route," to the Illinois line north of Rockford, a distance of about 40 miles; also northward from Portage about 60 miles through Grand Rapids, Wis., to a connection with the Wisconsin Central near Stevens' Point; and also a branch from Portage northeastward to Oshkosh, about 60 miles. The President of the Madison & Portage Company says: "It is expected that the unfinished portions of the road in Wisconsin will be put under contract for construction as soon as the proper application can be made for local aid, and it is hoped that the unfinished portions from the State line to Grand Rapids will be constructed by the first day of January, 1872."

The line of the Rockford Central north of Rockford has been finally located, extending nearly due northwest to the State line at a point 13 miles west of Beloit and crossing the Western Union Railroad nine miles west of Rockton. The length of this section is about 18 miles.

The consolidated line from Mendota, Ill., to the connection with the Wisconsin Central near Stevens' Point will be about 250 miles long, on a line nearly north and south. It is expected that the great lumber regions of the Wisconsin River and Green Bay and the iron ore of Northern Wisconsin will afford a heavy traffic southward, while the coal of Illinois will load cars going northward. In connection with the Illinois Central, the roads south of the Ohio and the Wisconsin Central, it will form a great north and south line from Lake Superior to the Gulf of Mexico. The Wisconsin Central will connect it with the Northern Pacific, and it may be used as a connecting link between that road and Chicago, and the South and East.

It is hoped that the part of the Illinois line between Wisconsin and Rochelle will be completed by the end of this year, at which time, if the Wisconsin line has progressed as is expected, there will be a line about 175 miles long extending from Grand Rapids southward to Rochelle.

New Issue of Lake Shore Stock.

At Cleveland last Thursday a meeting of the Lake Shore & Michigan Southern Railway Company was held to decide on issuing \$15,000,000 of new stock. Of the 350,000 shares of the company, 238,236 were represented at the meeting, all of which, except 86%, voted in favor of the new issue.

This issue is announced to be "for the purpose of completing a double track and for other improvements." Just how much will be realized from it, it will be impossible to say; but it is reported that the stockholders will be given an opportunity to purchase it at considerably less than the market price. A large sum, doubtless, can be used to advantage by the com-

pany, the business of the road having grown so heavy, especially between Toledo and Buffalo, that it cannot be done economically on a single track, and, indeed, at some times it cannot be done at all without serious delays. If the money realized from the sale of the stock is invested in such improvements, there is every probability that the company will be able to earn the usual dividends on it, whether it will on the face of the stock or not.

THE COST OF GRADING NARROW AND BROAD-GAUGE RAILROADS.

We have received the following letter, signed by two engineers in Virginia, who say they "prefer to withhold their names unless some good can be accomplished by attaching them."

Since our last article on this subject was written, we have consulted with some persons interested in the construction of narrow-gauge roads, thinking that there might possibly be some elements in the problem which we have omitted or misapprehended. We have been told by some of them that possibly we might show, *theoretically*, that there was little difference in the cost of constructing a light road of 4-feet $8\frac{1}{2}$ -inch gauge, as compared with one of 3 feet, but that, *practically*, there was a very material difference. We are therefore glad to be able to furnish our readers with the information given in the letter below, which is not theoretical, but in the highest degree practical:

"RICHMOND, Va., July 20, 1871.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following figures, the results of actual experience in a high, rolling, Piedmont country, serve to fortify your position with regard to the "narrow gauge":

LENGTH OF LINE, 29 MILES—GAUGE, 4 FEET $8\frac{1}{2}$ INCHES.
Average excavation in road-bed, per mile.....11,330 cubic yards (or 12,251, including ditching, etc.)
Average embankment in road-bed, per mile.....15,000 cubic yards
" cutting upon 4.39 miles.....6.15 feet
" filling upon 14.61 miles.....7.30 feet
Width of cuts at base.....16 feet
Width of embankments, on top.....10 feet
Slopes..... $\frac{1}{4}$ to 1 in cuttings, and $1\frac{1}{2}$ to 1 in fills
Grade of road.....4 feet $8\frac{1}{2}$ inches

From the above it will be seen that the minimum dimensions at all admissible with the ordinary gauge have been adopted in this case.

Let us reduce them as for a 3-foot gauge: We shall have, of course, the same slopes, and the respective bases will be 14 feet and 8 feet:

Average excavation per mile.....10,126 cubic yards (or 10,997, including ditches, etc.)
Average embankments per mile.....18,628 cubic yards
Proportion of reduction in excavation.....10 per cent
Proportion of reduction in embankments.....10 7-10 per cent (or an average of about 10 $\frac{1}{2}$ per cent.)

The cost of the earthwork was \$3,500 per mile.

Reducing cost even in proportion to *volume*, which every railroad builder will pronounce a fallacy, we shall save in this item \$367, or upon the 29 miles, \$10,643.

Now as to masonry:

The total cost was.....\$31,240
Or per mile.....1,076
Number of box drains.....22
Average length.....78 feet
Number of arch culverts.....8
Average length of arch culverts.....140 feet
Box drain masonry would be reduced.....8 per cent
Arch culvert.....1 $\frac{1}{2}$ "
Saving in masonry on the entire line.....\$350 (or not quite \$2 per mile.)

This piece of road is now graded and ready for the track. It has actually cost for land damages, grading, masonry, engineering and all other expenses, \$169,368. The aggregate saving as above computed might have been \$11,200, or about 6% per cent.

The company has not purchased the iron or equipment. They may lay slender rails and use light rolling stock, or they may prefer a more substantial superstructure for the adopted gauge, but except in one item they can effect no material economy by reducing it. The cross-ties cost about \$1,000 per mile for the wide-gauge, and for the narrow \$660—difference \$340, and for the whole distance say \$10,000. But, even in this respect, the advantage is more apparent than real, for with light rolling stock and light rails, cross-ties for the wide gauge may be reduced in dimensions and an equal economy effected.

Your views and arguments with reference to this whole question appear to need nothing to render them sounder or stronger. Most of the essays which have been written in favor of the narrow gauge are based upon the curious misconception that any arithmetical proportion can be established as a rule between the gauge and the cost of railroads. A trotting wagon has a wider gauge than a locomotive, but it is hoped that no one will be found to argue from this fact that the weight of rolling stock increases inversely as the gauge. Yet such a doctrine would be scarcely less wide of the truth than many which are gravely put forth by the advocates of the new system."

From the report of the Joint Committee appointed by the Legislature of Massachusetts, we find that their estimate of the cost of grading a road with 2-feet 9-inch gauge and average depth of cutting and embankments reckoned at four feet, is \$4,604; whereas the actual cost of grading the above road with an average depth of cutting and embankments of 6.72 feet was only \$3,500. We do not, of course, draw the deduction from

this, that all broad-gauge roads will cost less to grade than narrow ones, nor to account for the reason of the above difference, but simply give it to show that the cost of grading a road is not in proportion to its gauge.

The Effect of Grades on Resistance and Cost of Moving Trains.

Upon a judicious application of grades and curves, in the location of a railway the success of the undertaking in a great measure depends. We may spend so much in obtaining light grades and curves of large radius, that the business of the road never can pay the interest of the first outlay; and we may introduce grades so steep and curves so sharp that the cost of hauling trains may consume the whole income. Between these extremes lies that application of grades and curves which shall, without extravagant outlay, give a road that can be economically operated, and thus be at once a public improvement and a profitable investment. In order to apply the best system of grades and curves to a projected railway, and at the same time be able to compare the merits of any number of lines having different characteristics, it is necessary to understand what effect upon the working of a railway these elements have.

The resistance to the movement of a railway train upon a straight and level road depends upon a variety of conditions; such as the state of the rolling machinery and the tracks, the climate, the season, and even the weather. According to Mr. D. K. Clark, whose experiments were made as nearly as possible under the conditions of ordinary practice, the total resistance is given by the rule—

$$R = \frac{V_2}{171} + 8$$

in which R is the resistance in pounds per ton of the engine, tender and train, and V the velocity in miles per hour. The rule supposes the line to be straight and level, the weather favorable, and the track and machinery in good order. Thus at 20 miles an hour the resistance would be—

$$20 + 8, \text{ or } 10.3 \text{ lbs. per ton.}$$

The resistance due to a grade of any inclination is found by the simple rule of multiplying the load by the height and dividing the product by the length of the incline. Thus the resistance per ton due to a 24 feet grade is

$$24 \times \frac{24}{5280}, \text{ or } 10.2 \text{ lbs.}$$

The resistance to motion, therefore, upon a 24-feet grade is double that upon level with the velocity assumed above; so that the power required to draw a train up one mile of 24-feet grade, at 20 miles an hour, would draw it two miles on a level. As the resistance upon a level, however, increases with the speed, the greater the velocity of the train the steeper is the grade to require a double expenditure of power, as shown by the following table:

Speed in miles per hour.	Resistance in lbs. per ton.	Grade in ft. per mile to double the resistance.
18	9.3	23
20	10.3	24
25	11.7	27
30	13.3	31
40	17.4	41
50	22.6	53

Thus, while a grade of 24 feet per mile doubles the resistance at 20 miles an hour, at a speed of 50 miles we should require a grade of 53 feet per mile to do the same thing.

Inasmuch as the total resistance offered by any incline depends upon the amount and not the rate of ascent, we may compare lines having different systems of grades by making an allowance for each foot of vertical rise; or we may determine the number of feet of ascent which shall involve an expenditure of power equal to that required to move the train one mile on a level, and divide the whole ascent on any line by that number; the quotient being the number of miles to be added to the actual distance to get the equivalent horizontal length, or, as it has been termed, the equated distance. For example, if we take the speed as 25 miles an hour, the number of feet of vertical ascent which shall consume an amount of power sufficient to haul the train one mile on a level is by the preceding table 27. If we have a line 100 miles long with 540 feet of ascent the equivalent level length would be

$$540 + 27 \text{ or } 100 \times 20 = 120 \text{ miles.}$$

The above has been a common mode of equating for grades, and represents a length proportionate to the power expended. But it does not represent a length proportionate to the cost of exerting that power, which is what we require. Of the whole expense of operating a railway, probably not over one-sixth is doubled by doubling the power exerted. Instead, therefore, of adding a mile for each 27 feet of ascent (or other number according to the speed) we should add only one-sixth of a mile; or we should multiply the number in the third column of the preceding table by six, by which we get the following:

Speed in miles per hour.	Rise in feet to double the cost of working.
15	129
20	144
25	163
30	186
40	248
50	318

Thus at a speed of 25 miles an hour, for each 27 feet of ascent we shall consume an amount of power sufficient to move the train one mile upon a level; but to consume an expense sufficient to maintain and operate one mile we must ascend six times that amount, or 162 feet.

In descending, the grade instead of being an obstacle becomes an aid, as the train will roll down the incline of its own accord if it is steep enough. The momentum, too, acquired during the descent becomes useful in helping the train after the foot of the grade is reached, but only to a slight extent. The available momentum depends upon the speed of the train when it arrives at the foot of the incline, and not upon the length or total amount of fall that has been traversed. As soon as the grade becomes steep enough to let the train roll down of itself we make a saving in the amount of fuel used in the engine; but if the grade is ten times steeper we do no more. Thus, in making a reduction on account of descending grades, in order to find the equivalent level length we do not reverse the process by which we find the addition to be made in ascending, as the gain from any descent does not depend upon the total amount of fall. If 25 feet per mile is enough to allow the train to descend by gravity, using only steam enough to lubricate the cylinders, for every mile of such descent we save the fuel which would haul the train one mile upon a level; and as about one-eighth of the expense of the operation is chargeable to fuel we may for each 25 feet of fall in any mile deduct one-eighth of a mile from the measured length; and for every mile of grade descending at a less rate a proportionate amount; but for any excess over 25 feet no allowance should be made. Thus, if we descend a mile upon a 40-feet grade we may deduct one-eighth of a mile for 25 feet of the 40, and throw aside the remaining 15 feet.

Much difference of opinion exists among engineers as to the utility of any rule for equating for grades. So much depends in practice upon the rate of ascent, upon the disposition of grades with regard to the direction of the traffic, and the adaptation of the motive power, that it is plain that no mere rule, however correctly established, can be empirically applied to the various problems occurring in railway location. It is, however, equally plain that the amount of power employed must bear a fixed and exact relation to the amount of ascent and descent upon the road, and, therefore, in the hands of an engineer who is able to appreciate the various elements of the important problem of the best arrangement of grades, a rule for equating will be of service.

The steepest grade upon a line is not necessarily the ruling or controlling grade. The maximum grade upon the Pennsylvania Railway on the eastern slope of the Alleghenies is 95 feet per mile, while the maximum upon the western slope is but 53 feet. This latter grade, however, is opposed to the heavily loaded freight trains going eastward, while the 95 feet grade is opposed to the lighter trains going westward. The length of a grade has also to be regarded. An engine intended for ordinary work will take a train over a short but steep incline, while the same incline long continued would be beyond the steam producing power of the engine, though the adhesion might be amply sufficient.

In passing a high dividing ridge, where the traffic is to preponderate greatly in one direction, we should endeavor to ascend that slope of the ridge *up which* the loaded trains must go by a long development giving easy grades, while we may descend upon the opposite side more abruptly. If the traffic was to be equal in both directions the ruling grades should be made as nearly as possible alike on both slopes. The right disposition of grades is much more essential upon a road doing a regular and heavy freight business than upon a road devoted to passenger and light mixed trains.—*American Railway Times.*

—The Railroad Committee of the Connecticut Legislature has prepared a bill for the government of railroad passenger fares in that State, and the measure is before the Legislature with the recommendation of the Committee that it should pass. The bill contains seven sections, and provides that no company shall charge more than four cents a mile for the transportation of a passenger and his ordinary baggage over its road. Three cents per mile shall be the limit of such fare on roads whose profits amount to eight per cent. per annum; and two and a half cents per mile on roads whose annual profits are equal to ten per cent. A charge of ten cents is allowed between any two stations on a road. Infractions of this law are to be punished by a fine of \$20, half of which sum shall go to the person prosecuting the complaint. Companies are required to print their rates of fare distinctly, and to keep them hung up in every public room of all the passenger station-houses on the line of their roads, under penalty of a fine of five dollars for each day's neglect.

The Harlan & Hollingsworth Company.

About 800 men are now employed at their works in Wilmington, Del. Their chief business is iron ship-building, but about 300 men are engaged on car work. They are now making three drawing-room cars for the through line from Philadelphia to Niagara, over the North Pennsylvania, Lehigh Valley and Erie roads. This line will strike the Erie road at Waverly. The cars are 60 feet long and 10 feet wide, and will accommodate 48 passengers. The trucks have six wheels, and are what is known as Welsh's truck, as it was designed by Mr. Ashbel Welsh, President of the United Railroad Companies of New Jersey. The Harlan & Hollingsworth Company are also building five Pullman cars and rebuilding three more; are building six passenger cars for the West Wisconsin road—four of which have just been shipped: two for the Jackson, Lansing & Saginaw, and six for the Evansville, Terre Haute & Chicago line.

Contributions.

THE FAIRLIE RAILROAD SYSTEM.

No. 9 VICTORIA CHAMBERS,
WESTMINSTER, LONDON, E. C., July 11, 1871.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The number of your very interesting journal for June 3 contained a contribution from E. C. Rice, St. Louis, Civil Engineer, upon a subject on which I must ask your kind permission to offer a few remarks. I fear, however, that the distance which separates us will render their arrival too late to fulfill any practical purpose.

Mr. Rice has displayed much ability in founding an article upon extracts taken from my paper on "The Gauge for the Railways of the Future," and it is a matter for regret that this ability should be misapplied in an endeavor to establish an erroneous conclusion.

I am at present so fully occupied with work for narrow-gauge railways that I cannot do more than glance at the chief points, of which Mr. Rice appears to have lost sight; but, before entering upon these, I must call attention to his inaccuracy or unfairness in having introduced words which I never employed into the passages which he professes to quote from my writings. I take the very first of these professed quotations as an example, and place Mr. Rice's version and the true one in parallel columns:

Mr. Rice gives:

Every inch added to the width of a gauge, beyond what is absolutely necessary for the traffic, increases the proportion of dead weight, increases the cost and danger of working, and, in consequence, increases the tariffs to the public, and reduces the useful effect of railways.

I wrote:

"Every inch added to the width of a gauge, beyond what is absolutely necessary for the traffic, adds to the cost of construction, increases the proportion of dead weight, increases the cost of working, and, in consequence, increases the tariffs to the public, and, by so much, reduces the useful effect of the railway."

Now, in this example, the effect of Mr. Rice's omission and addition is to alter the whole meaning of the paragraph and to introduce an entirely new element into the question. The original passage, and others of the same tendency, were written with reference to the traffic as actually conducted on the leading lines of Great Britain, and they were not intended to be regarded from an American point of view; in America, indeed, the conditions are wholly dissimilar.

In Great Britain there is much greater competition for traffic between different companies than in America, and the stations are much nearer together. In order to drop a small load of goods at a particular station without delaying the train, it is often necessary that this small load should have a wagon to itself, which may be detached and left behind, and which it may afterwards be necessary to bring back empty. It follows that wagons are run from point to point with very variable quantities of contents, sometimes full, sometimes half-loaded, sometimes nearly or quite empty—the first condition, as regards merchandise, being the exception rather than the rule. I have always stated, and now repeat, that coal and mineral traffic is excluded from my calculations, because it is governed by different conditions. Taking goods traffic only, the result is that in this country, if we take each wagon for the year round and follow it from place to place, with and without load, we find that it has carried an average of less than one-seventh of its own weight for every mile it has traveled. If the wagons were only one-fourth of their present weight, they would still be capable of carrying six times the present average load, and it follows that such a change would effect a saving of three-fourths in the dead weight hauled, without any corresponding reduction of the carrying capacity. If Mr. Rice will carefully reconsider the question, he will find that every word I have written upon it is fully borne out by facts. It is very possible that my observations may not apply to the same extent in American practice, on account of qualifying circumstances; but when due allowance is made for differences of detail, the same line of argument must everywhere hold good, and serves to establish a principle of universal applicability.

I have not time to examine all of Mr. Rice's figures, and will take it for granted that they are correct. Assuming this, I do not hesitate to say that, if the lines to which he refers were on the Fairlie 3-feet gauge and worked by the Fairlie engines and light stock, the results, however good at present, would be simply doubled.

On referring to Mr. Rice's first table, I find that the working expenses of American railways are extremely high. Notwithstanding your advantage over us in respect of filling your trains, that is, in hauling so little dead as compared with paying weight, the average of the working expenses over the 21 lines given is just 20 per cent. higher than in this country. I should be glad if Mr. Rice would account for this great difference in our favor!

In Mr. Rice's second table, the wagons and their full loads show a proportion of about one ton of dead weight to one ton of paying load. I find, however, on comparing my own examples of the proportion between dead and paying weight with Mr. Rice's statements, that he takes no account of the miles run by empty trucks. So serious an omission entirely destroys the value of his table; but, even if we leave this source of error out of account, it still needs no argument to show that a 3-feet gauge, with the dead bearing to paying weight the proportion of one to three, would be enormously cheaper than your present wide gauges, on which Mr. Rice himself assumes the dead and paying weights to be equal. In order to haul a thousand tons of paying goods your lines would be loaded with two thousand tons, and mine with only twelve hundred and fifty tons, of total train weight. The difference of seven hundred and fifty tons would represent the saving effected by my system in consumption of fuel, as well as in the wear and tear of the permanent way and rolling stock.

Mr. Rice attributes to me one statement which I can only meet by simple contradiction. He says: "It is asserted by Mr. Fairlie that there is more danger in working a 4-feet $8\frac{1}{2}$ -inch gauge than a narrower gauge." I never asserted anything of the kind; and I have already called attention to the unjustifiable introduction of the word danger into the passage which Mr. Rice has altered from my writings.

Lastly, I have to call attention to the very serious mistake, common to Mr. Rice and nearly all others who have written upon the question, of attributing to the narrow gauge a limited carrying capacity. No error could be greater or more grave. The truth is, as I have constantly stated, and am prepared at any time to prove, that a Fairlie 3-feet-gauge railway, maintaining a mean speed of thirty miles an hour, will convey more passengers and more merchandise of all kinds, either in twenty-four hours or in twelve months, than any of the best broad-gauge railways in America worked upon the present system; each gauge being worked to its fullest extent, either upon a single or double track. This statement is no idle boast, for I have already accomplished the work and established the facts on the new narrow gauge in Russia. Experience is so much better than argument that I subjoin the following particulars.

"The Imperial Livny Russian Narrow-(3-feet 6-inch) Gauge Railway" is built and worked on the principle I have for so many years advocated. The line is fifty-seven versts (thirty-eight miles) in length, and has very sharp curves and heavy gradients. The worst gradient is 1 in 80 for seven versts.

The line and its equipment have been completed for less than two-thirds the cost of the most cheaply constructed broad-(5-feet) gauge line in Russia. The train loads are 345 tons gross, exclusive of engine, and the dead weight of such a load is only 91 tons. This leaves a paying load of 254 tons, or 2.8 to 1. If you will compare this result with the working of your own lines, on which the loads are nearly as one to one, you will find that to move the 254 tons of goods you must have at least 250 tons of wagons, instead of the 91 tons which in Russia daily perform this duty. The general result is that a comparatively light engine, on a light and inexpensive narrow-gauge road, suffices for a train carrying more tons of goods than are moved on any of the Russian broad-gauge lines, and I much doubt if any of your broad-gauge lines in America could do more. It must be remembered that the Livny line has a gradient of 1 in 80 for five miles, with many small reversed curves; and also that which I have just described as its actual performance falls short of what could be done on the Fairlie gauge of only 3 feet.

If any of your readers should wish for independent testimony to the accuracy of the above statements, they can ascertain the facts for themselves by addressing His Excellency, Count Alexis Bobrinskoy, Minister of the Railway Department of Public Works, St. Petersburg, or Professor Saloff, President of the narrow-gauge system in Russia, Technical School of Engineering, St. Petersburg, or, Ladislas Klupell, Esq., Secretary to the Imperial Livny Russian Narrow-Gauge Railway, St. Petersburg.

ROB'T F. FAIRLIE.

Poughkeepsie Bridge.

Horatio Allen has handed in to the Poughkeepsie Bridge Company a plan for a suspension bridge 180 feet above the surface of the water and 3,400 feet in length, with two spans of 1,100 feet in length, and half spans of 650 feet each, the towers to be of masonry and the foundations to be constructed seventy feet below the surface of the water. The cables are to be of steel or iron, and the carrying capacity of the bridge to be half a ton to the lineal foot. The whole structure is to cost \$2,000,000.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—W. W. Borst, of Denver, formerly connected with the Pennsylvania Railroad, has been appointed Superintendent and General Ticket Agent of the Denver & Rio Grande Railroad.

—Francis Chandler, late General Ticket Agent of the Vandalia road, and formerly with the Columbus, Chicago & Indiana Central, and some years ago with the Chicago & Rock Island, and a remarkably capable officer, has been appointed General Ticket Agent of the North Missouri Railroad.

—The Burlington & Southwestern Railroad Company elected the following directors on the 12th inst.: James Putnam, P. Henry Smyth, C. P. Squires, R. F. Hosford, A. W. Parsons and N. P. Sunderland, of Burlington; and John Severance, Thomas B. Weakley and Jeff. Chandler, of St. Joseph, Mo. The following officers were chosen: James Putnam, President; P. Henry Smyth, Vice-President; Jno. H. Davey, Treasurer; N. P. Sunderland, Secretary, and R. F. Hosford, General Superintendent. Messrs. Putnam, Smyth, Squires and Sunderland were in the old directory. Four others succeed J. H. Potter and John Davey, of Burlington, and J. C. Walker and J. Atlee, of Fort Madison, Iowa. The other is an additional member, the number of the board having been increased from eight to nine. The President and Treasurer are re-elected; the new Vice-President was Secretary last year.

—J. E. Williams, Esq., for many years connected with the Little Miami road, and more recently with the Indianapolis & Vincennes road, has been appointed Resident Engineer of the Indianapolis, Cincinnati & Lafayette Railroad.

—At the 22d annual meeting of the stockholders of the Raleigh & Gaston Railroad Company the following directors were elected: Dr. W. J. Hawkins, Col. S. S. Royster, J. B. Batchelor, A. M. McPhee, Col. Walter Clark, Col. George Little, of the old board, and Hon. P. C. Cameron. After the stockholders' meeting adjourned, the board of directors met and unanimously re-elected Dr. W. J. Hawkins President; Captain A. B. Andrews, General Superintendent; Hon. D. M. Barringer, Major T. B. Venable and Major R. S. Tucker were re-elected a Finance Committee.

—At a meeting of the directors of the Peoria & Springfield Railroad Company, held on Monday the 10th day of July, the board organized by the election of James Haines, of Pekin, as President; John T. Stuart, of Springfield, as Vice-President; Sidney Pulsifer, of Peoria, Treasurer; Geo. N. Black, of Springfield, Secretary; A. J. Ware, of Pekin, as Attorney.

—At a meeting of the Western Extension Railway Company, which is constructing the New Brunswick end of the European & North American Railroad, in St. John, New Brunswick, recently, the following gentlemen were elected directors for the next year: Alex. Jardine, Lewis Carville, W. B. Robinson, Thomas R. Jones and Robert Robinson. At a subsequent meeting of directors Alex. Jardine, Esq., was re-elected President, and T. Barclay Robinson, Esq., Secretary and Treasurer.

—It is reported that Jeremiah Prescott, for sixteen years past Superintendent of the Eastern Railroad of Massachusetts, has accepted an appointment as Superintendent of the Northern Pacific Railroad, with headquarters at St. Paul.

—The articles of association of the Railroad Building, Loan & Savings Association of Fort Wayne were filed in the office of the Secretary of State on the 25th inst. The capital stock is \$1,000,000.

—At the annual election of the Burlington & Missouri River Railroad Company, held in Burlington on the 26th inst., the old board was re-elected with one exception, Mr. C. E. Perkins, of Burlington, the General Superintendent of the road being chosen in place of the retiring member.

CHICAGO RAILROAD NEWS.

Northwestern Iron and Steel Welding Company.

Under this name a corporation has recently been formed in Chicago for the introduction and sale of Beazell's patent flux, of the value of which in welding iron and steel stories are told which would be utterly incredible if they were not sustained by the names of scores of the most eminent and skillful manufacturers and metal workers in the country. Such men as Mr. Cassatt, late Superintendent of Machinery of the Pennsylvania Railroad; Henry Disston & Son, the eminent saw makers; Philip S. Justice, Morris, Tasker & Co., the Duquesne Iron and Steel Works, and many other well-known Pennsylvania manufacturers, and the following master mechanics, N. E. Chapman, of the Cleveland & Pittsburgh; James Sedgley, of the Lake Shore & Michigan Southern, S. J. Hayes, of the Illinois Central; G. W. Tilton and R. W. Bushnell, of the Chicago & Northwestern, and C. J. Jauriet, of the Chicago, Burlington & Quincy, unite in testifying to the wonderful effect of the flux in experiments tried by themselves or under their immediate observation. Among these are the welding together of pieces of Bessemer rails, steel tires and axles, welding scrap steel into bars, welding cast steel upon malleable cast iron, welding together copper rods, restoring burnt steel, etc.

The Chicago company owns the right for Ohio and Michigan and all the territory west of these States as far south as the Ohio River, and including Missouri, Kansas, California, and all the territories. The directors are L. Tilton, E. B. Phillips, George L. Dunlap, Charles Fargo, A. B. Pullman, L. B. Boomer, and Thomas W. Mizner. E. B. Phillips is President,

Charles Fargo, Vice President, and L. Tilton, Treasurer. The office is at Room 2, Major Block, No. 154 Madison street.

Western Union Telegraph.

The following statements were made in the recent annual report of this company for the year ending June 30, 1871:

"The net profits from July 1, 1869, to July 1, 1870, were \$2,27,045. The net profits for the year ending July 1, 1871, \$2,547,854. For the six months ending July 1, 1871, the net profits were \$1,216,459. The resources of the treasury have been applied to the purchase of the capital stock, which has been reduced from \$41,000,000 to \$35,000,000. The bonded debt is about \$4,000,000. In 1867 the company had 93,399 miles of wire; in 1870, 119,452 miles; in 1867, 3,061 offices; in 1870, 4,391 offices; in 1870 the company transmitted 9,846,635 messages; the gross receipts in 1867 were \$6,043,000; in 1870, \$7,21,000; net profits in 1867, \$2,477,200; in 1870, \$2,352,750; construction of new lines cost in 1867, \$415,000; in 1868, \$355,000; in 1869, \$673,000; in 1870, \$400,000. The average tolls on messages in 1867 was 86 cents, and the average expense for each message 56 cents. In 1870 the average of tolls on messages was 71 cents, and the average expense of each message 51 cents."

Lake Shore & Michigan Southern.

The New York Tribune having said that if this company should increase its stock to \$50,000, "the question of future immediate dividends would be at least 'problematical,'" the Buffalo Commercial Advertiser comments as follows:

"In order to make the expression of such an opinion perfectly fair, the Tribune ought to have gone into the subject a little further. It ought to have said that if such an increase of capital is ordered the probability is that a call in cash for a large portion of the increase will be made, to pay for laying a double track on the railway the whole length of its line from Buffalo to Chicago. The call and the double track are just as probable as the increase of the capital stock, for these hypothetical events have always been put together, one depending on the other. Now, if the company should lay a double track, there is not a railroad man in the country but would say that they could earn more money at less expense, even without the increase of business which would be sure to follow such an increase of facilities. The prospect for dividends, therefore, with the increased capital, would be better instead of 'problematical,' provided that the money is used to complete a double track. No railway in the country is in a better position than the Lake Shore to justify such enterprise."

"Louisiana Route."

The Chicago & Alton's new line to Kansas City, which will be by the main line of that road from Chicago to Bloomington, by the Jacksonville Division from Bloomington to Roodhouse, by the branch now in course of construction from Roodhouse to Louisiana, Mo., by the Louisiana & Missouri River Railroad from Louisiana to Mexico, Mo., and by the North Missouri Railroad from Mexico to Kansas City, will be advertised and known as the 'Louisiana Route.' The only section yet to be completed is that between Roodhouse and Louisiana, which is well advanced, and on which the track will doubtless be laid during the coming month. The Louisiana & Missouri River road was lately completed between Louisiana and Mexico and this section (51 miles) will be opened for business on the 1st of August. A remarkably fine transfer boat has been obtained for the crossing of the Mississippi at Louisiana, and when the line is opened, which will be shortly, the magnificent day cars of the Chicago & Alton and Pullman palace sleeping cars will run through between Chicago and Kansas City. The character of the accommodations to be offered is unsurpassable, and there is every reason to believe that the 'Louisiana Route' will become widely and favorably known.

Chicago & Alton.

The company is building, at its shops in Bloomington, under the direction of Mr. Jackman, the Locomotive Superintendent, two new locomotives.

The earnings for the third week of July were:

1871 (miles).....	\$137,984 37
1870 (miles).....	100,307 75

Increase (26 per cent.).....

\$28,676 62

These show the largest receipts for a single week that the road has ever had, and are as satisfactory as they well could be.

Chicago & Northwestern.

The completion of this company's Baraboo Air-Line from Madison to Lodi, 2½ miles, was celebrated with enthusiasm by a large excursion party on the 25th inst.

The question of building a line from Milwaukee to a point near Lodi seems to remain *in statu quo*, but the company appears resolved to do it if the Milwaukee & St. Paul shall make its proposed new line into Chicago.

It has been decided to construct the Menominee Extension through Oconto instead of Stiles. The two places have been contending for the line since the surveys commenced. The route through Oconto is about two miles the shortest and is but a little distance from the bay.

The company has determined to build a branch from Stanwood, Iowa, —52 miles west from Clinton—south, 8½ miles to Tipton, the county seat of Cedar County. It is announced that the work is to commence immediately and be completed within 90 days.

Chicago, Rock Island & Pacific.

The company has now between fifty and sixty hands at work on the new stock yards at Genesee, 23 miles east of Rock Island, building platforms for chutes, unloading lumber, digging wells, etc. It has also about a mile and three-quarters of side tracks nearly completed, and is rapidly pushing the work forward, so as to have the yards all completed in time to receive the fall

shipments. It expects to expend between \$30,000 and \$40,000.

The company commences operating the section of the Chicago & Southwestern railway between Princeton and Trenton on the 30th instant.

Chicago, Danville & Vincennes.

Trains are now running regularly on this road from Chicago south to Milford, 94 miles, and the track is laid about 8 miles beyond to the Iroquois and Vermilion County lines. It was expected that the end of the track would be within 20 miles of Danville this week. The grading is completed to Danville, and the iron at hand ready to lay.

The Conductors' Life Insurance Company.

James Marshall, President of the United States and Canada Railroad Conductors' Life Insurance Company, has issued a call for an annual gathering of that association at Hooley's Opera House, Chicago, on Wednesday, October 4.

Chicago & Southwestern.

The construction of what remains to be done to complete this road from Leavenworth to the Rock Island road, at Washington, Iowa, is progressing at the rate of from 1½ to 2 miles a day. The grading is entirely done, and the track-layers, going from Trenton, Mo., westward, have this week reached a point five miles west of Jamestown, or 21 miles from Trenton. There now remains but about 26 miles of iron to be laid to reach Cameron, and complete the entire main line of the road. Below are given the stations and distances from Washington on the completed portion of the road—Washington to near Gallatin, 190 miles, and Cameron to Missouri River, 52 miles—and on the 26 miles of road, graded but not yet ironed, between Gallatin and Cameron:

	Miles.		Miles.
Washington.	0	Princeton.	144
Brighton.	13	Bell's.	11 3/4
Acheson.	21 1/2	Pickard's.	15 3/4
Fairfield.	28	Tindall.	163 1/2
Libertyville.	34 1/2	Trenton.	169
County Line.	41	Hickory Creek.	177
Eldon.	46 1/2	Jamestown.	185
Floris.	52 1/2	Gallatin.	19 1/2
Belknap.	59	Cameron.	2 6/7
Drakeville.	69 1/2	Plattsburg.	235
Unionville.	7 1/2	Garrison.	243
Centerville.	87 1/2	Edgerton.	246 1/2
Numa.	95	Camden Point.	254
Reymour.	108	Tracy.	263 1/2
Allerton.	11 1/2	Beverly.	266 1/2
Linnville.	129	Missouri River.	268 1/2

By the Rock Island road from Chicago to Washington the distance is 257 miles, which will make the journey from Chicago to Leavenworth by this route 253 miles. This is not a very short route, as compared with others now existing. By the Burlington and Hannibal & St. Joseph roads the distances are from Chicago to Kansas City, 480 miles; to St. Joseph, 469 miles, and to Leavenworth, 514 miles. By the same roads, and the Chicago & Southwestern from Cameron to Leavenworth, the distance is only 44 miles. By the Chicago & Alton's new Missouri line to Mexico, which will soon be in operation, and the North Missouri road a route will be opened but 487 miles from Chicago to the Missouri River at Kansas City.

Though the Chicago & Southwestern's new line is somewhat longer than either of the other routes reaching from Chicago to the Kansas roads in Northeastern Kansas, it will be likely to receive a fair share of the business, and also to develop a very large local business, running as it does through a fine rolling farming country in Northern Missouri and Southern Iowa, which has been hitherto inaccessible by rail.

The "Atchison Branch," from Plattsburg northwest to Atchison, will probably be built very soon—soon enough to be among the first to use the Atchison Bridge, which it has been determined to construct at once.

To-morrow, July 30, the Chicago, Rock Island & Pacific Company will take charge of and operate another section of the main line, from Princeton to Trenton, 24 miles.

OLD AND NEW ROADS.

Athol & Enfield.

This Massachusetts Railroad was opened to North Dana, about 15 miles on the 11th inst.

Ontario Lake Shore.

We learn that "a meeting of the directors of this railroad was held in Oswego on the 12th instant, to take into consideration the bids offered for the construction of 55 miles from Oswego west. There being, however, an unusual number of bids (upwards of fifty), it was considered more prudent to leave the matter in the hands of the Executive Committee, who were within a few days to close a contract, probably, with one party, for the whole. Fifteen of the bids, from reliable contractors, were under \$20,000 per mile, including fencing, and several at \$18,000 per mile, and some at a much lower figure. The cost will probably not exceed \$18,000 per mile."

Peoria & Rock Island.

This road is now open for business with regular trains running between Peoria and Rock Island. A great excursion of twenty cars drawn by two engines, celebrated the opening of the road on the 26th inst.

Massachusetts Central.

The entire stock (\$3,000,000) has been taken, and the roads along the line will soon be called upon for 20 per cent. of their subscriptions. In several, however, new meetings must be held ratifying formal votes, owing to relocations, or other conditions upon which the money was voted.

Connecticut Western.

The track of the Western Division of the Connecticut Western Railroad, was laid to the State line of New York, near Millerton, at noon on the 24th inst., and connected with the Dutchess & Columbia Railroad. Trains

will run through to the Hudson River, at Fishkill, about the first of August, from Canaan, Conn., on the Housatonic, to Dutchess Junction on the Hudson River Railroad.

Lease of the California Pacific.

The statement that work on the Adelante or Sonoma extension of the California Pacific Railroad had been suspended is ascertained to be correct; and the rumor that the Central Pacific Company was about to commence forthwith the construction of its short line of road from Sacramento to Oakland, crossing at the Straits of Carquinez, was immediately followed by another, to the effect that this powerful corporation had actually bought out the franchises, rights and property of its great rival, the California Pacific—railroads, steamers, lands and all. There is every probability that this latter report is correct, and that the formal transfer of the railroad lines of the California Pacific Railroad Company, together with the fleet of steamers it had recently purchased of the California Steam Navigation Company, into the possession and control of the Central Pacific Railroad Company, will now soon be consummated. Of course this will obviate the present construction of another line of road from Sacramento to Oakland, and will put an end to the talk of extending the California Pacific through Beckwourth's Pass overland, to meet the Kansas Pacific.

This immense transaction leaves the Central Pacific Company sole master, without rival, of the railway system of California. It will use its power, we trust, to promote the welfare of the State, and in such a manner as to conciliate the good will of the people whom it serves. Intelligently directed, and with a real desire to benefit the country and accommodate the people, a corporation of this magnitude can better satisfy the wants of community than an aggregation of smaller ones. The capitalists of the Central Pacific Company are old Californians, who know the temper of the people and what the State requires. We believe that they themselves are disposed to pursue a liberal policy in dealing with the people. By so doing they will undoubtedly consult their own best interests, and secure the largest returns from their investment. Masters of the railroad situation, as they now are, they can afford to be generous; and in fostering and developing the material interests of the State, and encouraging the advent of a large population within its borders, the lines of railway belonging to them will find increased occupation, and will yield returns commensurate with the growth of the young empire of which they constitute so essential and important a feature.—*San Francisco Call.*

Changing Gauge.

The cost of changing the Ohio & Mississippi locomotives from the 6-feet to the standard gauge was about \$3,500. This work was done on 28 locomotives at the company's shops in East St. Louis, Vincennes and Cochrane. Fifty cars belonging to the passenger stock were changed at a cost of \$150 each. The St. Louis Republican gives as follows the reasons for moving both rails instead of one in narrowing the gauge:

"The extreme breadth of the present gauge has been the greatest difficulty the company has had to encounter in changing it. In all previous changes of gauge there has only been one line of rails to be moved, the other remaining in the old position, but in this case to follow such precedent would be to move one line of rails 15 inches toward the middle of the track. The effect would be to throw all the weight of trains to one side of bridges, cattle-guards, culverts, trestles, etc., etc., thus increasing accidents, while the inconveniences resulting from such a change would have been extreme. The platforms at all the stations on one side of the road would have been rendered partially useless, and it would have been necessary either to extend them outward or to bring the track in to them, entailing heavy expense, much loss of time and great inconvenience. Water tanks on the same side of the track would also have been rendered unserviceable. It was, therefore, deemed necessary to move the rails seven and one-half inches nearer the middle of the track on each side, thus overcoming all the difficulties referred to, and giving greater solidity to the track."

Atchison, Topeka & Santa Fe.

Trains are now running regularly on this road between Topeka and Newton, a distance of 132 miles. Newton is about three miles south and one mile east of the southwest corner of Marion County. The trail of the Texas cattle on the way to Abilene passes very near to this place, and as it is about 60 miles south of Abilene, this new railroad hopes to get a large part of the cattle shipments which were formerly made by the Kansas Pacific. The new stations beyond Cottonwood are Elmdale, Cedar Grove, Florence, Peabody, Whitewater and Newton. There are a mail and an accommodation train daily over the line.

Cincinnati & Mackinaw.

Another effort is to be made to obtain means for the construction of a railroad from Cincinnati northward through the western tier of counties of Ohio to the Michigan line, to connect there with other roads, thence through Lansing to Mackinaw. Such a road would be generally about 20 miles west of the Cincinnati, Richmond & Fort Wayne road, and as far or farther from the Dayton & Michigan.

South Side of Long Island.

The laying of a second track on this railroad through the village of Jamaica, which will complete the double track the entire length of the road, was stopped on Saturday, the 23d inst., by an injunction granted on the request of the Trustees of the village, who withhold consent unless the company promises reform in its management.

Wisconsin Central.

The Madison, (Wis.) Journal, of the 21st, says: "The prospects of the speedy completion of the Wisconsin

Central road from Ashland to Stevens Point is good. Ashland County has voted to issue \$200,000 in bonds to aid the road, on condition that the line be completed in two years. Duluth people look upon the route with special favor, because it gives them access to the iron bed and a direct line to Chicago. It is ninety-two miles from Stevens Point to the Pemoka range, and twenty-three from there to Ashland. This route will pass through Portage and Madison. From the entry of St. Louis River to Ashland is sixty-five miles; but from the same entry to the range would be, directly, but fifty-six miles; thence to Stevens Point ninety-two miles; and from Stevens Point to Chicago two hundred miles; making this line the most direct between Duluth and Chicago. Of the whole distance, 348 miles, 180 are now constructed and in successful operation, and we believe that the link from Portage to the Point will be put in as soon as the road beyond is completed."

Proposals will be received until noon of August 10 for furnishing material and constructing the foundation for the bridge of this road over the Wisconsin River at Stevens' Point. They may be sent either to the office of the contractors, No. 5 Ogden Building, southeast corner of Lake and Clark streets, Chicago, or to D. W. Wellman, Chief Engineer, Menasha, Wis.

Springfield & North Western.

The contractors, Kilbourne, Bower & Co., of Keokuk, are laying track on the graded portion of this line, from Havana southwest to Petersburg, 26 miles, and will soon commence grading the section between Petersburg and Springfield.

Madison & Portage.

In the expectation that their entire time will be occupied in the extension of the Madison & Portage road, both south from Madison to Mendota, in Illinois, and north from Portage to Grand Rapids and Stevens Point, the Madison & Portage Railroad Company have executed a temporary lease of their road to the Milwaukee & St. Paul Company, by whom it will, for a time, be operated; the terms of the lease being such that either party can terminate it on thirty days' notice.

The New Jersey Lease.

An argument was commenced in Chancellor Zabriskie's Court, at Trenton, N. J., on the 26th inst., on a motion for a perpetual injunction, forbidding the United Companies of New Jersey and the Pennsylvania Railroad Company from perfecting a lease of the property of the former company. On motion of ex-Secretary of State Black, a postponement of the case was granted until Wednesday, in order to enable the plaintiff's counsel to examine the reply of the defence.

Kansas Pacific.

Land grant bonds of the Kansas Pacific Railway Company, with coupons of July 1, 1871, attached, Nos. 301 to 360, inclusive, \$500 each; Nos. 250 to 286, inclusive, \$500 each; Nos. 301 to 400, inclusive, \$250 each; Nos. 451 to 500, inclusive, \$250 each, were stolen from the United States Express Company, at St. Louis, July 25, 1871. The public are cautioned against negotiating for the same.

Hocking Valley.

There is talk of forming a connection between this road at Columbus and Toledo, by using the Cleveland, Columbus & Cincinnati road from Columbus to Delaware, constructing a new line about 75 miles long from Delaware northwest to the Dayton & Michigan road at Ottawa, and using the 51 miles of the Dayton & Michigan into Toledo.

Jeffersonville, Madison & Indianapolis.

It is now reported that unexpected obstacles prevented the consummation of the lease of this road to the Pennsylvania Company, but that an agreement has been made for the purchase of that road by that company. It is understood that the Pennsylvania Company will take \$2,000,000 stock in the Jeffersonville road, at 75 cents on the dollar, and assume the bonded and other indebtedness of the Jeffersonville road. It also agrees to take the stock owned by the Jeffersonville road in the Ohio River Bridge at par. This would give it a controlling interest in the bridge.

Lake Erie & Louisville.

This railroad, extending from Fremont, O., (29 miles southeast of Toledo on the Lake Shore & Michigan Southern Railroad), southwest 37 miles to Findlay, O., was sold on the 27th inst. at Fremont under a decree of the United States Circuit Court, in foreclosure of certain mortgages. It was bought by N. A. Cowdrey and George T. M. Davis, in trust for the creditors.

Canada Southern.

Detroit is talking of constructing a line to St. Clair in order to connect with this road. Mr. Melton Courtright, one of the officers of the Canada Southern, at a meeting of citizens of Detroit, said that all the means necessary to secure the construction of the main line from the Niagara River, opposite Buffalo, to Amherstburg, and the branch to St. Clair River, was secured. The main line and branch were both under contract, and the entire grading of both would be finished by the 1st of January.

Minneapolis & Duluth.

This company has completed its track from White Bear Lake on the Lake Superior & Mississippi Railroad, southwest about 15 miles into Minneapolis, a large force working all day last Sunday, in anticipation of an injunction forbidding the crossing of the approach to the suspension bridge across the Mississippi. The road is to be operated by the Minneapolis & St. Louis Company.

Waynesburg & New Holland.

There is talk of building a railroad of this name from Waynesburg, the western terminus of the East Brandywine & Waynesburg Railroad, westward to a connection with either the Pennsylvania Railroad or the Reading & Columbia. From Waynesburg to New Hol-

land, about ten miles, the route has been located. The amount necessary to grade it is nearly subscribed, and it is expected that work will be commenced on it in a few months.

West Wisconsin.

Minneapolis desires a connection with this road without passing through St. Paul. To effect this it is proposed to construct a bridge over the St. Croix at Stillwater, and a branch thence southeast about fifteen miles to Hammonton, a station of the West Wisconsin, and run cars by way of the new road from Minneapolis to White Bear Lake, the branch of the Lake Superior & Mississippi from White Bear Lake to Stillwater, and thence by the proposed road. It seems not to be considered that the West Wisconsin may object to shipments which would leave about 30 miles of its road for another. The branch to Stillwater, however, would give a desirable connection with the Lake Superior & Mississippi road, Duluth and the Northern Pacific.

The people of Red Wing are talking of constructing a branch of this road from Menominee southwest about 35 miles to their town.

Bloomington & Ohio River.

The Shawneetown *Mercury* says work is progressing rapidly on this road. "It will form a junction with the Fox River road at Fairbury, and the Springfield & Illinois Southeastern at Louisville, Clay County, thus creating a continuous line of road to Chicago from Shawneetown, independent of the Illinois Central Railroad."

Princeton to Amboy.

Engineers are surveying a route for a railroad from Princeton a little east of north to Amboy, Ill., a distance of about 25 miles.

Atchison Bridge.

A company was organized at Weston, Mo., on the 15th inst., to construct a bridge over the Missouri at Atchison. F. H. Winston and George C. Campbell, of Chicago; J. N. Burns and H. M. Aller, of Weston, Mo., and John Doniphan, of Missouri, were chosen directors. All of these, except Mr. Doniphan, are directors of the Chicago & Southwestern Railway Company. Stock to the amount of \$503,000 was subscribed, \$500,000 of which was by the Chicago & Southwestern Company. It was agreed to transfer the stock to such men as may be agreeable to the Central Branch Union Pacific Company, if a union with that organization could be effected.

The telegraph announces that at a meeting held in Boston on the 24th instant, in which the Central Branch Union Pacific, Chicago, Burlington & Quincy, Hannibal & St. Joseph, Chicago & Southwestern, and Atchison, Topeka & Santa Fe railroads were represented, it was agreed to construct a bridge across the Missouri River at Atchison, the work to be commenced immediately.

Central Branch Union Pacific.

It is reported that this company has made arrangements to extend its road up the Republican River to connect with the Union Pacific at the one hundredth meridian.

Leavenworth, Lawrence & Galveston.

On the 10th inst. this road was opened to Cherryvale, Montgomery County, 124 miles south of Lawrence, and 16 miles southwest of Thayer, the winter and spring terminus of the road. The Southwestern Stage Company now connects at Cherryvale for points in the Indian Territory and Texas.

Galveston, Harrisburg & San Antonio.

An election was to be held in Galveston, Texas, next month to decide on a proposition to subscribe aid to this proposed road, but on the 17th inst. the company asked that the ordinance ordering the election be repealed, and giving as a reason that a large number of persons not citizens of Galveston were being registered for the purpose of defeating the subscription, and that other illegitimate means were practiced to secure that end. The ordinance was repealed. The Galveston, Houston & Henderson Company was charged with having adopted these means to defeat the proposed subscription.

Indianapolis, Cincinnati & Lafayette.

The suit to force this company into bankruptcy has been on trial in the United States Court at Indianapolis parts of this and last week. The taking of testimony was closed last week, and the case was then laid over until the court shall give notice when argument would be heard.

Minneapolis & St. Louis.

This company has the work on the section of its line from Minneapolis southwest to Carver, about 25 miles, well advanced, and will soon commence laying track. It is to be completed to Carver in October.

New York & New Haven and Hartford & New Haven.

A bill authorizing the consolidation of these roads has passed the Connecticut Senate.

The New York Viaduct Railroad.

Some points of great interest in connection with the Viaduct Railway have lately been under the consideration of the directors. One of the most important of these is the character of the business they propose to carry on. It has been at last determined to carry all the freight and express traffic, as well as passenger, that can be obtained. With regard to the passenger travel, the public has before had the estimated figures. The directors propose to make arrangements with the New Haven, Hudson River, and Harlem railroads, by which both passenger and freight cars shall run from the Forty-second Street Depot over the viaduct line. This arrangement, they think, will greatly facilitate the delivery of freight in different parts of the city. The directors also intend to make a feature of the express business. By having an express agency at each depot, with baggage-wagons constantly in waiting, they expect

to become the recognized carriers of small packages and parcels—in fact, to assume, in this respect, somewhat the character of the London Parcels Delivery Company, which has been carried on for the last thirty years with such marked success.

Another important point settled is the width of the gauge. The line will be 50 feet wide, and the gauge the ordinary one of 4 feet 8½ inches. This width of gauge has been decided upon in order to admit of connections with the existing lines running into New York, and also with the Erie line, which must some day cross the Hudson River, if it wishes to compete with the New York Central in carrying Western traffic.—*New York Tribune*.

Cincinnati & Baltimore.

Contracts between the Marietta & Cincinnati and the Cincinnati & Baltimore roads, and the Cincinnati & Springfield Railroad, for the joint use of the track through Mill Creek Valley, were ratified on the 22d by the two former roads. This track is the property of the Cincinnati & Baltimore Company (corporation controlled by the Baltimore & Ohio), and extends about six miles north from Cincinnati, giving an entrance into the city. As the Cincinnati & Springfield is a Vanderbilt company, this contract confirms former indications of harmony, and in some things an alliance, between the Baltimore & Ohio and the Vanderbilt interests.

Detroit, El River & Illinois.

This railroad, which is to be the eastern extension of the Detroit, Hillsdale & Indiana, has ten miles of track laid, from Columbia City, Ind., on the Fort Wayne road, 19 miles northwest of Fort Wayne, southwest to the town of Springfield.

Louisville Bridge.

It is reported that the troubles between the Pennsylvania and Ohio & Mississippi, with reference to the joint use of the Louisville bridge, have been settled in such a way as to secure to the latter road the desired privileges.

Lafayette, Bloomington & Western.

A telegram from Bloomington, dated the 26th, says that the contract for laying iron on this road has been awarded to Ford, Cottingham & Mitchell at about \$400 per mile. Work upon the road-bed is going on, and the iron is expected in August, when the track-laying will at once begin.

Bolivar & Baxter Springs.

The Baxter Springs (Kansas) *Sentinel* says: "That a contract for the entire construction of this proposed railroad was let on the 11th inst., with the condition that the work shall be commenced as soon as the County Commissioners in Missouri shall have issued the necessary bonds for the building of their portion of the road. This road is to extend from Baxter Springs, in Cherokee County (the southeastern county of Kansas), in a northeastern direction through Jasper, Barton, Dade and Polk counties, Mo., to Bolivar, in the latter county. From Boliver it must look for an outlet either to the Laclede & Fort Scott road, when it shall be built, or to an extension southward from the Missouri River. The line is nearly parallel with that of the Atlantic & Pacific, and for the most part as much as 30 miles from it.

St. Paul & Chicago.

This company's bridge at Hastings is to be completed by the 25th of September, by which time the road is to be completed to Winona and the Winona Bridge in order, so that cars may then run through by that route from St. Paul to Chicago or Milwaukee. If, however, as has been intimated, the Milwaukee & St. Paul will have control of this line, it will have to construct a new road from Milwaukee to LaCrosse in order to utilize it independent of the Chicago & Northwestern.

New Orleans, Jackson & Great Northern.

The first train on this road to leave the New Orleans station since the beginning of the Bonnet Carré crevasse left on the 24th inst. Thirteen miles of the road were injured by the flood. For more than three months passengers have been taken to a station near Lake Ponchartrain by steamboats. The repairs, it is said, have been very thoroughly made.

Mexico & Monroe City.

The St. Louis *Republican* says: "The preliminary survey was commenced on the 10th, and it is anticipated 20 days will suffice to do the field work. The initial point of the survey is Mexico, from which two lines will be run to Monroe City. It is expected within a few weeks to have the route located and the estimates fully made."

Quincy, Missouri & Pacific.

The Quincy (Ill.) *Whig* of the 22d says: "The issue and delivery to the Directory of the Quincy, Missouri & Pacific Railroad, of \$250,000 (in bonds) of the \$500,000 to said road, by the city of Quincy, is another evidence not only of the good faith of Quincy in this matter, but of the progress that is being made towards the construction of the road. They have already been registered in the Auditor's office at Springfield, and are ready for sale. The amount of subscriptions along the line of road, beside the Quincy subscription, amount to \$1,118,900. A further subscription of \$481,100 will be needed along the line before the second \$250,000 from this city will be available. The first issue will assist materially in prosecuting the work to Edina, which is expected to be completed before the first of January next. Mr. Savage, the President of the road, reports thirty miles of the road from West Quincy about ready for the ties and iron, with the grading and bridging for the remainder of the distance to Edina under contract, and iron enough purchased and under way to lay the track to Edina."

Vera Cruz & Mexico.

The entire length of this line, including the Puebla Branch, will be 296 miles. Of this, 169 miles are in operation and 17 more will be opened very soon. It is

expected to have it completed by the end of next year.

Central of Iowa.

This company is making a survey of a line from Mason City (the present northern terminus) north by west towards Albert Lea, on the Southern Minnesota. A survey has also been made of a line from Mason City northwestward to Wells, which would be unprofitable close to the Burlington, Cedar Rapids & Minnesota road.

Burlington & Southwestern.

The bridge over the Des Moines River at Farmington, which was commenced on the 4th of June, was to have been completed on the 22d inst. The grading between Farmington and Bloomfield is done, and the iron for this portion is now arriving. Mr. J. W. Barnes will have charge of the track-laying. He expects to put down a mile a day, and reach Bloomfield by the middle of September. Mr. Sumner, in charge of an engineering party, is locating 25 miles of line between Moulton, Iowa, and Unionville, Mo., which it is expected to soon put under contract.

Grand Trunk.

The *Toronto Leader* says that the Grand Trunk Railway Company, in connection with leading British capitalists, and with the approval and support of the Dominion Government, are about organizing an ocean line of steamers. The proposed steamers will depart from Montreal in summer and Portland in winter.

Cincinnati, Lafayette & Chicago.

This company is constructing a railroad from Lafayette northwestward to the Chicago, Danville & Vincennes Railroad at or near St. Anne, crossing the Toledo, Peoria & Warsaw at the State line. Grading is completed on some sections and progressing nearly all along the line, iron is already received, and it is intended to have it completed within two months. The track of the Lafayette, Bloomington & Mississippi road will be used for 16 miles west of Lafayette. The distance thence to St. Anne is 45 miles. This will give a new route between Chicago and Lafayette and will enable the Danville road to receive traffic from Cincinnati, Louisville & Indianapolis.

Missouri Valley & Western.

There is a rumor that the Central of Iowa has made a contract with this company to use its road, when completed, as its outlet to St. Louis, instead of the North Missouri, which was originally intended to make the connection, and with which it is generally supposed that a contract had been made long ago. If this is done, the connection will be made at Glenwood, and it will be necessary to extend the Central southwest to that point, instead of Moulton. From Quincy southward a road yet to be completed will be used.

Detroit, Lansing & Lake Michigan.

Trains commenced running regularly on this road between Detroit and Brighton, Livingston County, on the 24th instant. The distance is 42 miles.

New York to Saratoga.

Two trains daily now run through between New York and Saratoga, with magnificent Wagner drawing-room cars made expressly for the line.

Anderson, Cicero & Frankfort.

The articles of association of this railroad company were filed in the office of the Secretary of State of Indiana on the 22d instant. The eastern terminus of the road is to be at Anderson, Madison County, and the western at Frankfort, Clinton County, and is to pass within one mile of the town of Perkinsville, Shawtown, Cicero, Boxleytown, and Kirklin. The length of the route is about fifty miles, and the capital stock is \$2,000,000. Such a road could be used as a feeder either of the Bellefontaine or the Pan-Handle line.

Chicago to Muscatine.

Parties are canvassing the country between Chicago and Muscatine to obtain aid for a railroad which it is proposed to construct from Calumet (14 miles south of Chicago) by way of Joliet, Homer and Dover to Muscatine. Such a line would be nearly parallel with, and for the most part a few miles (rarely so much as eight) north of, but at its western end a few miles south of, the Chicago, Rock Island & Pacific Railroad. It is intended to connect with the proposed road from Muscatine across Iowa to Council Bluffs.

West Wisconsin Bridge.

It is reported that an agreement has been made with the people of Stillwater to construct this bridge with steamboat draws increased from 100 to 140 feet each, and the raft span reduced from 206 to 160 feet. If this is done, it is understood that no attempt will be made to prevent the construction of a bridge at this point.

Northern Pacific.

The company offers its lands (except timber lands) on the following terms: 10 per cent. of the price down; 10 per cent. in one, two and three years; and 15 per cent. in four, five, six and seven years, with interest at 7 per cent. The company's bonds are received in payment at a premium of 10 per cent. Thus the settler who buys 160 acres of land at \$5 per acre will pay \$80 down, \$80 with the interest on \$720 (\$50.40), in all \$130.40 at the end of one year; \$124.80 at the end of the second year; \$119.20 at the end of the third year; \$153.60 at the end of the fourth year; \$145.20 at the end of the fifth; \$136.80 at the end of the sixth; and \$128.40 at the end of the seventh year.

If the price of the company's bonds should remain at par, he will be able to make a reduction of \$10 on each payment except the first, which is smaller than the lowest denomination of bonds. But it is not anticipated that the bonds will long remain low enough to be of value for this purpose, but they will doubtless be in demand by those who wish to pay in full for their lands on purchasing, as the company advertises no deduction for cash.

Atlantic & Pacific.

On Thursday of this week trains were running as far as Oseuma, in the Indian Territory, 20 miles west of the State line. The trains of the Missouri, Kansas & Texas road were in sight from the end of the track, and the junction will be effected early in August. Track-laying advances at the rate of a mile a day.

Minnesota Railroads.

The work on the main line of the St. Paul & Pacific has been prosecuted with such energy that we are now promised an excursion to Breckinridge, on the Red River of the North, 216 miles distant from St. Paul, by the 15th of September next. The whole line is graded, and the cars running to Morris, 159 miles from St. Paul, and the iron is being laid at the rate of more than a mile each day.

Orders have been received to place under contract the line from Sauk Rapids to Brainerd, and to have the same completed before the 1st of January.

The road from Saint Cloud to Pembina, via the Sauk Valley, will also be prosecuted with great vigor during the season, and it is believed Sauk Centre will be reached before "the snow flies."

The Northern Pacific Railway is completed to Oak Lake, nearly one hundred miles west of the Mississippi, and is taking long strides "toward the far West, where rolls the Oregon."

The railway from St. Paul to Hudson, connecting with the West Wisconsin at that place, is under contract and will be pushed to completion at the earliest practical moment. The iron, rolling stock, etc., are now on the way from the East.

The St. Paul & Chicago Railway (from St. Paul to Winona) is completed to Lake City, and will probably reach Winona in November.

The Hastings & Dakota Railway is nearly completed from Farmington to Shakopee, and will reach Carver, and probably beyond that point, the ensuing fall.

The line from Minneapolis to White Bear Lake is nearly completed, and that from Minneapolis to Carver will be in operation in November.

The St. Paul & Sioux City Railway moves on steadily toward its destination, and it is believed that in less than a year St. Paul will be connected by iron bands with the metropolis of Dakota.

The railway from St. Peter to New Ulm is under contract, and will be in operation in less than a year.—*St. Paul Pioneer*, July 20.

Minnesota & Northwestern.

The Blue Earth City (Minn.) *Post* "learns from a reliable source" that it is doubtful whether the iron will be laid on the graded part of this line, from Wells northwest to Mankato, and whether any grading will be done south of Wells. The section from Wells to Mankato would give the Southern Minnesota a valuable connection with Mankato.

Burlington, Cedar Rapids & Minnesota.

This company has laid out a new town called Elm Springs in Butler County, Iowa, 35 miles northwest of Cedar Falls, and about fifteen miles west of Nashua. It is reported that this place will be made the terminus of a division.

The company is soliciting subscriptions in aid of two branch lines; one from Cedar Falls northeast 60 miles through West Union to Postville on the Milwaukee & St. Paul road, and one from Vinton nearly due west 50 miles to Liscomb on the Iowa Central.

Missouri, Kansas & Texas.

Construction trains were moving on the Cherokee Division of the road last week as far south as Flat Rock Creek, 85 miles from the Kansas line, and within 18 miles of the Arkansas River, to which it is to be completed about the 1st of August. It is intended to complete the line entirely through the Indian Territory by the end of this year.

Cincinnati, Richmond & Fort Wayne.

The following telegram dated at Fort Wayne, July 21, gives the following account of the lease of this road to the Grand Rapids & Indiana Railroad Company, and other companies:

"At a meeting of the stockholders of the Grand Rapids & Indiana Railroad, at Sturgis, Mich., on July 19, a contract for leasing the Ft. Wayne, Richmond & Cincinnati Railroad to the former for a term of ninety-nine years was agreed upon and accepted by a large majority of the stockholders. The proposed parties to the lease are the Cincinnati, Hamilton & Dayton road, the Pennsylvania Company, now operating the Pittsburgh, Ft. Wayne & Chicago Railway, and the Grand Rapids & Indiana Railroad Company. The following are the leading conditions of the lease: The Richmond road, when ironed, to be equipped at the joint expense of the Grand Rapids & Indiana, the Cincinnati, Hamilton & Dayton and the Pennsylvania companies, and operated in their interest. The net earnings of the road, after paying all expenses of running it, to be paid to the Richmond Company, or used for its benefit in paying its bond interest, the three companies furnishing the funds for its equipment, reserving 10 per cent. interest of said amount for their benefit. The three companies mentioned also guarantee interest on \$1,800,000 of the bonds of the Richmond road to pay any instalment of interest that it could not meet. There was also an article providing for the transportation of freight, etc., in which it was agreed that the Cincinnati, Hamilton & Dayton road should throw all the trade in this channel that it can control, the favor to be returned by the Northern road. We understand the above arrangements have been sanctioned by the three companies, and it is thought they will soon be entered into. The completion of the Richmond road between here and Richmond—the consummation of this consolidation—will give a continuous through line between Cincinnati and Little Traverse Bay, a distance of about 470 miles."

Proposals will be received on the 1st of August, by the President, William Parry, for the grading of the

section of this road between Portland and Decatur, about 26 miles. It will be let in sections of from two to three miles in length.

Burlington, Cedar Rapids & Minnesota.

The Burlington *Hawkeye* says: "The work between Cedar Falls and Mason City, a distance of about seventy miles, is in a very satisfactory state of forwardness. The grading and bridging are so far advanced that they can be kept out of the way of the track-layers. The iron is being rolled at Joliet, and is being delivered as rapidly as needed. The road will be completed to Mason City, 250 miles from Burlington, by the 1st of October."

Lafayette, Bloomington & Mississippi.

The part of this road which has been leased to the Toledo, Wabash & Western is that within the State of Illinois. A separate company owns the part between Lafayette and the Illinois line, which is all graded, and this section will be completed and operated in connection with the Lafayette, Bloomington & Muncie road. The Wabash Company may secure the use of this section to bring the trains of their new road to Lafayette, but if not they will construct a connecting line from the State line southeast to their main line at Attica, about 18 miles.

At a meeting of the directors of the Lafayette, Bloomington & Mississippi Railroad, held at Saybrook, McLean County, Ill., July 19, it was decided to change the line of the road east of Saybrook, at the crossing of the Gilman, Clinton & Springfield Railroad, to a point about two miles south of the present grade. Ties are being got out all along the line of the road, and track-laying will begin at Bloomington, Ill., early in August.

TRAFFIC AND EARNINGS.

The traffic receipts of the Grand Trunk of Canada for the week ending July 1 amounted to £32,500, against £28,900 in the corresponding week of last year, showing an increase of £3,600, or 12½ per cent.

The traffic receipts of the Great Western of Canada for the week ending June 30 amounted to £18,316, against £14,117 in the corresponding week of last year, showing an increase of £4,199, or 30 per cent.

The receipts for the six months ending June 30, 1871, on eighteen of the leading roads of Great Britain, give the following results as compared with the corresponding period of last year:

	June, 1871.	June, 1870.	Increase.
Bristol & Exeter	£203,800	£193,786	£5,614
Caledonian (23 weeks)	90,1,511	85,755	46,956
Glas. & S. Western (23 weeks)	2,3,69	278,388	5,311
Great Eastern	98,379	962,917	21,455
Great Northern	1,078,758	1,039,744	39,014
Great Western (22 weeks)	1,42,598	1,741,975	1,05,7
Lancashire & Yorkshire	1,305,648	1,279,4,0	116,348
London & Brighton	6,2,317	507,207	35,010
London & Northwestern	3,472,707	3,291,877	18,830
London & Southwestern	736,696	705,196	31,490
Manchester & Sheffield	590,315	669,067	91,248
Metropolitan	2,7,866	210,412	7,454
Midland	1,083,37	1,811,699	131,871
North British (22 weeks)	66,1,649	682,556	55,93
North Eastern	2,202,714	2,127,7,6	175,008
North London	160,37	167,902	1,135
North Taffordshire	253,371	241,429	10,851
South Eastern (22 weeks)	863,333	870,494	23,729
	£18,281,695	£17,244,251	£987,354

On these lines there was an aggregate increase of mileage of 150 miles.

MECHANICS AND ENGINEERING.

The Keystone Bridge Company.

This company are hard at work on the Cincinnati Bridge over the Ohio River, and the St. Louis Bridge over the Mississippi. These are, probably, the two largest engineering works now in progress in the world. The Mississippi Bridge we have so recently described that it is perhaps not necessary to do more than state that it is a steel-arch bridge with one span of 520 feet space and two of 502 feet.

The Cincinnati Bridge is a mere *miscellaneous* structure, and has 35 spans, as follows:

ON THE APPROACH FROM THE LITTLE MIAMI DEPOT TO FRONT STREET.

1 span of 96 feet, iron bridge	96 feet.
1 " 84 " " "	84 "
1 " 76 " " "	76 "
3 " 90 " " "	240 "
1 " 81 " " "	81 "
1 " 130 " " "	130 "
3 " brick arches	137 "

OVER THE OHIO RIVER.

2 spans of 96 feet, iron bridge	192 feet.
1 " 137 " " "	137 "
1 " 48 " " "	48 "
1 " 237 " " "	237 "
1 " 260 " " "	260 "
2 " 202½ " " "	405 "

ON THE APPROACH ON THE SOUTH SIDE.

8 spans of 44 feet, iron bridge	332 feet.
1 " brick arches	13 "
1 " iron bridge	50 "
5 " brick arches	105 "

Total... 3,910 feet.

The dimensions of the spans given above are from center to center of piers. Besides the clear spans given above, the roadway is carried for three or four hundred feet on returning walls at each end.

The height of the channel span of 418 feet from the top of the rail to low-water mark is 103 7-10 feet. This span is level but is approached on each side by inclines of 1 in 50.

A common roadway with track for horse cars is furnished on each side of the bridge by extending the floor beams far enough from the main truss.

The arrangement of this bridge was attended with peculiar difficulties, on account of the law of Congress requiring it to be raised higher than was at first designed. The grades or approaches of the streets and horse-railroad lines is different from that of the steam railroad, which complicated the difficulties very much.

The bridge is calculated to bear a distributed load of 2,700 pounds per lineal foot, and the rods of each panel are made strong enough to carry the greatest load to which they can be subjected by the passage of a locomotive.

The factor of safety for the parts in tension is 6, and for those in compression 5. The latter were calculated by Gordon's formula.

Besides the bridges at St. Louis and Cincinnati, the Keystone Company have in progress the

COMM'CTIC RIVER BRIDGE AT MIDDLETOWN.

4 spans of 200 feet, iron bridge..... 800 feet

1 pivot of 300 feet, iron bridge..... 300 "

2 spans of 50 feet, iron bridge..... 100 "

Total..... 1,900 feet

This bridge is of a wrought-iron trellis plan, patented by Mr. Linville. It has no vertical posts, and each rod intersects three opposite diagonals. It resembles a lattice bridge, but has the well-known Phoenix posts and a top chord made of channel iron. The diagonal rods are attached to the posts in a very ingenious manner, which forms part of the subject matter of the patent.

The company are also at work on the following bridges:

FOR THE CUMBERLAND VALLEY RAILROAD, OVER THE POTOMAC RIVER AT POWELL'S BEND.

7 spans, 147 1-7 feet, Howe truss (wood)..... 1,030 feet.

FOR THE PENNSYLVANIA RAILROAD, AT MT. UNION AND MANAYUNK.

10 spans of 130 feet, double-track iron bridge..... 1,300 feet.

THE LONG BRIDGE AT WASHINGTON, WITH THREE TRUSSES, FOR RAILROAD AND ROADWAY.

16 spans of 140 feet, Howe truss (wood)..... 2,240 feet.

2 " 88 " " " 164 "

1 pivot of 144 feet (wood)..... 144 "

1 " 130 " (iron)..... 120 "

Total..... 2,663 feet.

FOR THE FREDERICK-BURG & POTOMAC RAILROAD.

1 span of 110 feet, Howe truss (wood)..... 110 feet.

1 " 98 " " " 93 "

1 " 78 " " " 78 "

Total..... 236 feet.

FOR THE BALTIMORE & POTOMAC RAILROAD.

2 spans of 150 feet, Howe truss (wood)..... 300 feet.

1 " 180 " " " 180 "

1 " 50 " " " 50 "

Total..... 531 feet.

FOR THE APPROACHES TO THE DUBUQUE & DUNLEATH BRIDGE.

(Erected three years ago.)

8 spans of 96 feet (iron bridge)..... 768 feet.

Besides these described, they have orders for numerous small bridges for the Pittsburgh, Fort Wayne & Chicago, Cleveland & Pittsburgh, Pittsburgh, Cincinnati & St. Louis, Allegheny Valley, and other roads. Without including the latter, the Keystone Bridge Company have orders for 12,216 feet, or nearly 2½ miles of bridging. We doubt whether any other establishment in the world has so much bridge work under contract.

British Rail Exports.

Heyerdahl, Schoenberg & Co. make the following report of the exports of railroad iron from Great Britain, extracted from government returns:

TO	Month ending June 30.			Six months ending June 30.		
	1869.	1870.	1871.	1869.	1870.	1871.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
United States.....	26,714	46,065	44,9,9	165,348	197,045	244,784
Russia.....	34,072	36,988	12,731	86,796	114,454	46,929
Austrian Territories	3,753	3,585	8,645	16,723	19,17	5,518
British India.....	7,067	15,472	1,732	37,199	102,564	26,786
British North America	4,618	3,495	12,566	17,610	15,694	27,279
Egypt	29	—	183	8,740	1,564	646
Australia	2,315	446	1,516	12,299	5,075	10,469
Brazil	18	48	8,195	561	2,318	11,615
Holland	1,436	1,898	6,66	11,84	5,758	5,729
Spain and Canaries	1,020	1,038	709	6,693	9,080	5,568
Sweden	91	993	2,892	1,083	3,120	5,511
Chili	871	8,632	3,170	4,511	9,995	5,490
Spanish West India Islands	524	1	319	2,338	534	—
Pera	2,009	9,457	4,957	11,349	8,8,9	19,691
France	234	96	—	3,004	189	1,090
Germany	2,297	6,687	8,609	8,895	31,810	32,220
Other countries	8,463	5,048	7,407	38,059	30,817	34,801
Total.....	95,039	125,747	103,052	415,784	562,709	476,191

Total exports from Great Britain of iron and steel to all countries..... 253,600,318,581,313,373,1,354,914,1,481,100,1,440,196

It will be observed that there is an increase of nearly 25 per cent. in the exports to the United States over last year. The imports for the first half of this year are sufficient to iron 2,750 miles of track, and the amount shipped to the United States from Great Britain exceeds the shipments to all other countries.

Railroad Earnings in June, and from Jan. 1 to July 1.

Returns of traffic for the month of June have come in more slowly than usual, and show no general movement either in the direction of increase or decrease. There are very few roads among those included in the list below which are now operating the same mileage as last year, and the comparison of their earnings with those of 1870 is not, therefore, a certain criterion by which to estimate the actual extent of their business. In most cases where roads have considerably increased their mileage, the earnings *per mile* are not now equal to those of last year; but, as we have frequently pointed out, the expenses *per mile* on new roads or branches, where few trains are run, are so much below the expenses on main trunk lines, that it is not always possible to judge correctly of the profitability or unprofitability of the additions or extensions, until the year has passed and the whole details of operation are given in the annual report.

It is, however, pretty evident that the construction or leasing of new roads during the past few years, by some of the leading Western railroads, has in many cases been carried to excess so far as present profits are concerned. In the future growth of the country it is quite possible that almost every railroad thus far

constructed may become a paying route, but in the meantime, for a period of five to fifteen years or more, the companies which have leased or assisted in constructing the very numerous branch lines of the West will probably be at a loss in operating them, and be obliged to draw from the profits of the main lines to support the branches.

The Pennsylvania Central report admits that many of their Western leases result now in an annual loss, and the statement of operations contained in the reports of other companies, less conspicuous for the large extent of their leased lines, frequently shows the same thing. Railroad competition has recently been sharp beyond precedent, and the motives to the acquisition of new roads have frequently been the result of ambition on the part of officers and directors, or hostility to a rival company, rather than a sincere desire to promote the true interests of their own corporation. No more striking illustration of this fact could be produced than the war which is just now going on between the Chicago & Northwestern and the Milwaukee & St. Paul companies, each of them proposing to build a large number of miles of road for the purpose of injuring the other; it is more than probable, however, that the reports are circulated for speculative purposes.

The result of operations in the month of June will be seen in the following table:

	RAILROAD EARNINGS IN JUNE.			
	1871.	1870.	Increase.	Decrease.

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